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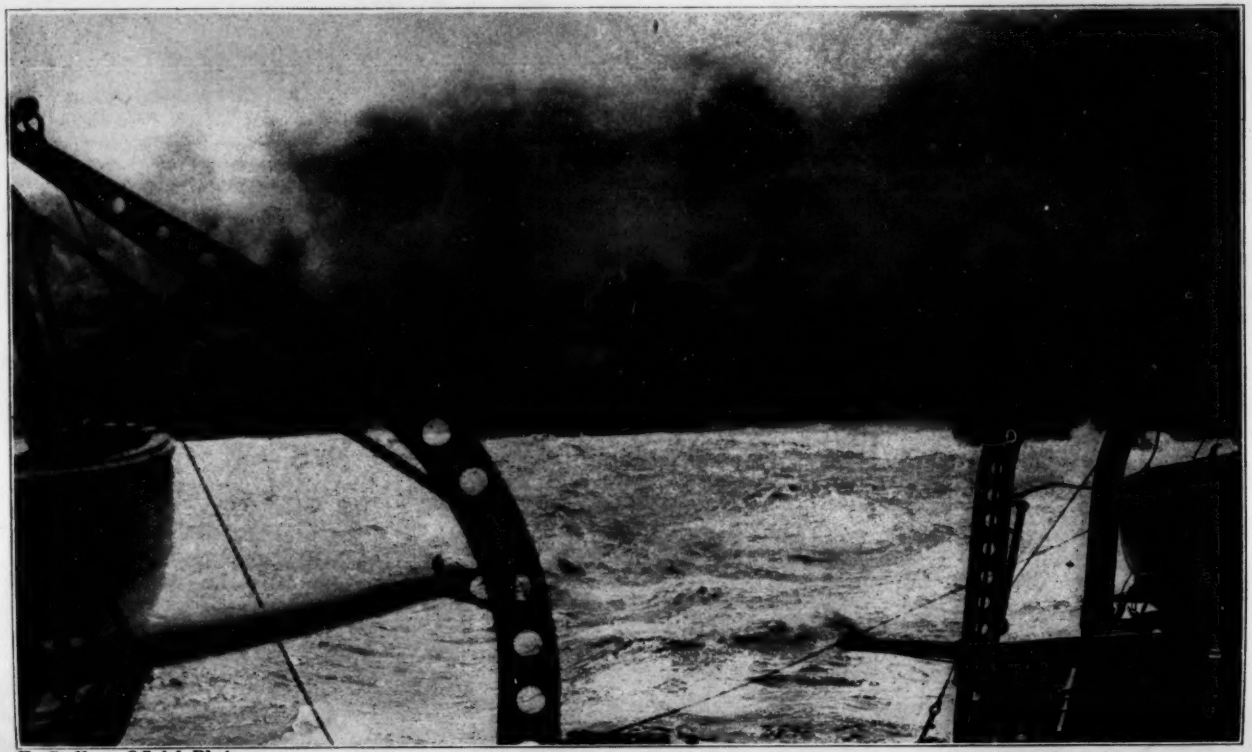

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NAVAL POLICY AND ITS RELATION TO WORLD POLITICS[1]

BY REAR ADMIRAL W. V. PRATT, U. S. NAVY

"The future of America is of greater importance to Christendom at large than that of any other country."—GLADSTONE.

1. FOREWORD

THE relationship existing between national and naval policy is one that is not always fully understood. It is only in comparatively recent years that there has been any attempt definitely to formulate it. Yet so wide reaching is its application, that its effect may be traced back almost to the dawn of history.

In the present article it is my aim to present you with a picture, in which may be discerned the bearing of our national policies to those of other nations, and the relationship which exists between our national policies and our naval establishment. To complete the picture, it is necessary first to give a brief historical résumé of some of the elements which, in the past, have greatly influenced national and naval policies. That these policies are inextricably interwoven is now accepted by every student of history.

2. HISTORICAL

Sea power and naval strength are not entirely synonymous terms. Sea power is composed of the factors, naval strength and maritime commerce, adequately apportioned to support each other

[1] From an address delivered before the Council on Foreign Relations, at a Conference dinner held in New York February 27, 1923.

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harmoniously. We find also, in the past, that military power has frequently played a more preponderating rôle, in matters of national moment, than naval power. As civilization has advanced, and as the seas, though separating great and growing countries from each other, have, nevertheless, through improved methods of communication, become more easily traversed, we find a later tendency for naval power to influence more and more the relationships existing between foreign states. The Phoenicians were great sea traders but relied for their protection upon alien forces; the Romans and Carthaginians knew little of the bearing of naval strength and sea power to state policy. From the beginning of the Christian era to the period of the Renaissance the various cultural interests of the world revolved in orbits of their own and to a great extent, were dormant. When the seas became more easily circumnavigated the centers of world interest came in contact more intimately with each other.

The association of maritime towns known as the Hanseatic League extended its commerce and influence by way of the sea into the Baltic and into England itself. Beyond protecting its interests from sea rovers, it went no further. Sea power meant then, sea trade.

Venice was always a maritime state, devoted to commerce, upon which she grew rich. Depredations from pirates forced her to arm her carriers, which later grew to a great fleet. At one time Venice commanded the Adriatic, the Ionian Islands, and the Black Sea. She held the trade route between Asia Minor and Europe and her goods found their way to India, by sea and by the caravan route overland. Constantinople fell to the Ottoman Turk, and the land route was cut. Venice still survived and her commerce flourished, but the discovery of the Cape of Good Hope route was a fatal blow at Venetian commercial supremacy. Her trade and sea power passed into the hands of the Portuguese, Dutch, and English. An appreciation of the distinction between the carrier of goods and its separate protector, in the shape of the armed ship, grew.

Portugal, like every great maritime state, discovered that the ideal of "sea power and commerce" led directly to Empire. The Sixteenth Century saw the rise of the great Portuguese Empire,

but it quickly waned and its power passed through internal dissension.

Spain endeavored to exclude all Europe from the waters of the New World, but her blind state politics drew her into wars with England on the sea. Her oversea possessions fell and her treasure ships became prizes.

Holland at one time swept the channel with her fleets. Her trade to the Dutch East and West Indies flourished, but her power also fell before that of England's fleets.

In turn, the Portuguese, Spanish, Dutch and the French, as well as the British, have extended their overseas domains, but up to a fairly recent period in world affairs, an appreciation of the connection between state politics and naval policy was very nebulous. The early sea pioneers extended their country's possessions but it was mainly with the idea of enhancing the power of the mother country at the expense of the subject colonies. The rôle which the subjugated races played in world affairs, had little weight in the minds of those directing the various state policies of that period.

Our own Independence, followed close on its heels by the French Revolution and that again followed by the Napoleonic Wars, directly changed the character of the relationships existing between neighboring European countries, and thus indirectly affected the bonds existing between the various European states and their colonies.

World politics, as many understand the term today, was born only about the time of the Act of Vienna in 1815, when an attempt was made to settle the chaos resulting from a European World War. Great Britain was the first nation to awake to a realizing sense of the part its navy played in the conduct of its foreign affairs. Spain, Portugal, France, and Holland at various times had held vast overseas domains but their overseas control fell before the power of England's fleet, or was swallowed up in the movements which grew out of the desire for independence, born shortly after our own and the French Revolution. Had Napoleon appreciated the true relationship of sea power to world power the face of Europe might have been changed and the character of European politics modified.

From having been swept by various invasions, Great Britain

realized that as the seas surrounded her, so should they be made to form her guard against encroachment. Here we have the genesis of her interest in matters naval. Later still, Great Britain learned, that sea power backed by naval power, enabled her to extend her influence over the world. The path was free for her colonizing projects; her commerce expanded; the colonies of her less far-sighted neighbors fell to her; the road to India lay open; she was able to spread the civilization of the Anglo-Saxon over the world, without let or hindrance. Preëminently through the influence of her fleet, exerted in the Napoleonic Wars, Britain was able to break the back of the greatest military organization the world then knew. In the councils of peace following the various wars which have swept Europe, she played the leading rôle. It was her position of naval strength which enabled her to be the great factor both in determining the policies of Continental Europe, and in extending its cultural influences abroad. In the main this sea power has been used wisely, with consideration for less fortunate nations. The power of the fleet enabled England to maintain the economic, commercial and industrial rôle so successfully played for over the last one hundred years. Finally, in the late war, the power of Britain's fleet was pitted against the great German military machine. Once more naval power broke the back of a military autocracy. No student of history can fail to see that naval power is opposed to militarism. In fact, it is far more the tool of the statesman than it is the instrument of the military dictator. These facts should be borne in mind, for they indicate conclusively that our statesmen should have a clear appreciation of the relationship of statecraft to naval and to sea power. From the Eighteenth Century up to the present time, Great Britain has had, and is the only country which has had, a definite naval policy, a policy which she has consistently followed; a policy which has been so closely affiliated with her foreign policies that the two have become almost inseparable. Before that date, the relationship of state policy to naval power, was unknown or was realized but vaguely.

During the periods spoken of, the United States and North and South America pursued their own courses, influenced but slightly by the scenes enacted upon the European stage. The justice of our movement for independence was espoused openly in England.

The full powers of Great Britain's Army and Navy never were used against us. Continental politics and wars amongst themselves occupied the attention of European states. We were left alone to develop our own resources and to gain strength until the day should come when we would be strong enough to maintain our position of independence. It may have been it was ordained that we should be given the opportunity to grow into a great world state, freed from the elements of suspicion, mistrust, and greed which have characterized European world politics. Practically, I think it was that cycle of events, the American Revolution, the French Revolution, and the Monroe Doctrine, which, together with an inherent distrust of foreign entanglements, are responsible for and give the national policies of the Americas the unique position in world political affairs they hold today.

It is doubtful if our statesmen of that day realized how intimate was the connection between the success of our movements for independence, and the uses to which England put her fleet. During the periods of greatest European strife our merchant marine, unprotected, carried much of the trade of England and France in its bottoms. For a time during the Revolution we had a few naval ships afloat. Then our naval power waned, in fact, disappeared. 1812 again found us unprepared and still with no definite naval policy. The war with Mexico was hardly a naval affair. The Civil War again found us building a great fleet but at its close this fleet was allowed to die. What was perhaps of greater importance, our merchant marine, without which we cannot be said to possess sea power, disappeared from the ocean. The Spanish War found us pitted against an inferior naval power. Fortunately we won, and with the acquisition of some of the remaining colonies of Spain, we entered the lists, through our overseas holdings, as a world power. Our fleet then was in fair way to take second rank.

Germany, disregarding the policies of Bismarck; ignoring the statecraft which had united a federation of states into a compact whole; and envious of the commercial supremacy which England had established; entered the list of world powers late. By intensive building she developed a fleet, which, at the beginning of the World War in 1914 was second only to that of England. We had then fallen into third place. Japan, closely studying the

methods of European states, determined, after the Russo-Japanese War in which she became a world power, that naval power was essential, if she were to exercise a determining voice in world, and particulary in Far Eastern, politics. The World War of 1914 came as a shock to the United States. By 1916 we had awakened and then, and only then, was a definite naval building program determined upon which would make us eventually second to no naval power in the world. The wisdom of this line of action had been apparent to naval men for many years, if we were to guarantee the protection of our own shores and were to exercise that influence in world politics which we, as one of the most powerful of nations, should exercise. Coincident with our projected plans or shortly after, Japan entered into a scheme for competitive naval building, which, if carried out, would have placed her in a position only slightly inferior to our own. Although naval thought, saw the wisdom of our 1916 program it could not be said to have received national sanction, for it was readily given up at the Washington Conference when conditions seemed to dictate that it should be abandoned, for the sake of greater apparent advantages to be gained.

3. The End of the Great War

The end of the great war found naval men unanimous in the opinion that our country should possess a fleet second to none. The contemplated 1916 program would, if carried to conclusion, put us in a position of superiority. The strain of the war had precluded Great Britain from devoting that attention to naval construction which was essential if she were to maintain her traditional policy of paramountcy on the sea. In fact, with their contemplated programs completed, the United States would rank first and Japan and England would be close to each other in the race for second place. War weariness and war numbness had produced a state of mind such, that, except among a few thinking men, the loss of her predominant sea power did not greatly agitate British thought. A little later the gravity of this situation made its appeal to the whole of England. When it is realized that England victoriously fought the Spaniards, the Dutch, and the French to maintain her position of sea supremacy, you can realize the

gravity of a situation which might arise, in case our national policies should run counter to England's, or to those of Japan.

Concurrent with this period, the Allies were endeavoring to arrive at solutions satisfactory to themselves through the treaty of Versailles. It was then that an inspiration, long a world dream, was born, which, had it been carried fully into effect, would have done much to influence naval policy. It was the League of Nations. Naval students of history and of statecraft have known that the world politics of the past involved a balance of power. Being practical men, responsible for their acts and for the advice they give, they, for the most part have inclined to the idea that future world politics would also comprehend a balance of power. Therefore, regardless of how altruistic the motives might be, the League of Nations' idea necessarily involved a balance of power on a great scale. Whether this concept be correct or not in a general sense, is not a matter under discussion. From the American naval viewpoint it was deemed unwise practically, for any naval sanctions to become effective, which allowed the balance of sea power to pass out of the hands of England and of the United States, or which distributed the ratio of sea power between the two, other than on even terms. Therefore, while naval thought had dictated a program in 1916, which for safety, would place us in a paramount position pending future developments, this naval policy was held in the balance until the fate of the League of Nations, so far as the United States was concerned, was determined. War experience had taught us the extreme importance of sea power, and of co-operate action with those countries who best understood the reasons for and the proper use of sea power. With the failure of the League of Nations concept to become a part of our accepted national policy, our naval program of 1916 again hung in the balance. It was at the mercy of our legislators, who, having different traditional backgrounds from those which brought sea power into being, naturally did not link naval power with national policy as any European statesmen would have done.

Out of the war there also grew another idea which had a direct bearing upon our future naval policy. This belief, maturing through the vicissitudes of one of the greatest of world conflicts, was that it is essential for the English speaking races to stand

shoulder to shoulder, if the civilization which mainly they had been instrumental in distributing throughout the world, should survive. The basis of solidarity among English speaking nations rests on: common laws; the same spirit of administration of justice; similar development of democratic institutions; common ideals; common interests; common governmental foundations; the same appreciation of individual liberty; and a similar spirit of fair play toward other peoples. The war indicated that this solidarity must be preserved and naval statesmanship had to take cognizance of this matter in any future naval policy affecting both countries.

4. The Conference at Washington

When the Conference met at Washington, Europe was no farther along on the road toward a stable peace than it had been at the time of the Armistice. The elimination of the Central Powers only changed the character of many of the problems with which European world politics had been concerned for over a century. Many of the causes of irritation had not been removed. New ones had been added. Whatever may have been the intentions of the makers of the Versailles treaty, its terms have not settled the conditions which will disturb Europe. The basic points of dissension between French and British national policy are about the same as they were before the entrance of Germany into the arena of world politics. From a naval point of view it is not necessary to discuss these matters, but in attempting to find adequate solutions to broad naval problems, these matters have to be considered. In addition to the troubles in the Near East and in Continental Europe, a new source of friction had arisen in the Far East, particularly in respect to our relations with Japan. The root of the trouble lay in the fact that each nation was suspicious of the other, and this mistrust was in no wise lessened by the fact that each of the two countries was apparently competing against the other, in the matter of naval armaments. While this might not have been a serious matter from our point of view, as we were spending relatively but a small part of our budget on naval construction (about twelve per cent), it was not so with Japan, who was spending over thirty per cent of her budget on her naval program. If naval expenditures were constrasted with total wealth,

this disparity would be still greater. As everyone knows, the Conference was called for the purpose of reducing naval armaments, and of stabilizing conditions in the Far East. If that could be accomplished by reasonable means, a good work would be done. In the event of future trouble one of the foci of disturbance, at least would have been removed from the world political arena. Then the efforts our country might be called upon to make, whether philanthropic, economic, or of whatever nature, could be concentrated in that one area where they might be required.

It so happened, that in considering the agenda upon which the discussions were to be based, it was easier to arrive at concrete decisions, through a settlement of the naval problems, than in any other way. It fell therefore to the lot of the Navy to deduce a formula, which could be applied satisfactorily, in a businesslike way, to a reduction of the naval armaments of the parties concerned.

Simple as it may seem to construct such a formula, it is nevertheless a work in which a thorough study of national and naval policy, tradition, past history, economic stability, potential capacity, racial characteristics and other complex elements, enter, in addition to technical naval factors.

There were certain things it was essential to accomplish. It was necessary to remove mistrust; it was necessary to stabilize conditions in the Far East; it was necessary to produce harmony of action among the participating powers, particularly with respect to Great Britain and ourselves; it was necessary to arrive at fair proportions in naval strengths, which should represent as nearly as possible, the just amounts each nation had a right to maintain, after all matters relating to this problem had been taken into account.

A naval formula was found which our delegates adjusted, balanced, and modified until the original American proposal was the result. It is not necessary to detail it. You are all familiar with it, and also with the naval treaty which was its outcome. Although the original proposal was not accepted in its entirety, Pacific problems were not responsible for this. The sources of disagreement lay in Europe where so many other controversial questions still exist. So long as discussions were kept strictly within the limit which the Conference originally intended, the

American proposal had fairly smooth sailing. Although complete agreement was not reached there was, however, one great point gained. In principle and in spirit the American proposal was accepted by the British Empire, which, traditionally, has always considered itself to be the guardian of sea power. As Earl Balfour said in the second plenary session, speaking of the American proposal,

> We agree with it in spirit and in principle. . . . What it does is surely one of the biggest things that has ever yet been done by constructive statesmanship. It deals with the three great fleets of the world, and in the broad spirit in which it deals with those fleets, in the proportion of disarmament which it lays down for those fleets, the Government of the country which I represent is in the fullest and the heartiest sympathy with the policy which the United States have brought before us for our consideration. . . .

and in speaking of the proportions of the battle fleet of the vessels auxiliary and necessary to a battle fleet, Earl Balfour further said,

> We think the proportion between the various countries is acceptable; we think the limitation of amounts is reasonable; we think it should be accepted; we firmly believe that it will be accepted. . . .

When you remember that the American proposal deliberately sacrificed the dominant position which our country was attaining, as the first naval power in the world; when you consider the traditions of England and the aspirations of Japan; you will see the give and take spirit indicated by the three leading naval powers in the 5:5:3 pact. Before such a ratio could be accepted, full consideration had to be given to all of the factors which affect one nation's relations to another. A victory of this magnitude, previously, had never been accomplished between great European states, without war, though a somewhat similar agreement on a very small scale had been consummated between Chile and Argentine in 1902, when certain naval restrictions were assented to, in order that the friction between these two countries, in existence more or less actively since 1897, should be allayed. The spirit which actuated the three great naval powers, in agreeing to the reductions and to the ratios established by the American proposal, can best be likened to that spirit underlying the Rush-Bagot agreement of 1817, which defines the amount of naval armament to be allowed on the Great Lakes. This contract has been so successful that it stands as a monument of what two nations can do

when they mutually respect each other, when their intentions are good and when their dealings with each other are fair and just.

It is unnecessary to discuss, in too minute detail, the effects of each of the five classes of agreements entered into at the Washington Conference: namely, first, the general agreements and resolutions relating to China and the Far East; second, the Four-Power treaty; third, the naval pact; fourth, the submarine treaty; and fifth, Article XIX of the naval treaty. No two men will agree as to the adequacy or the desirability of these agreements, in all matters of detail. It is impossible to reconcile the various national viewpoints without give and take on every side. The point to remember is, however, that these agreements are in the main good; that they accomplished certain definite results; and that they point the way to future solutions. They have removed many of the sources of friction in the Pacific; and they have helped to stabilize conditions in the Far East. They have brought the English speaking peoples closer together; and they have obtained sanction to the ratio idea for preserving the balance of sea power through agreement and arbitration, without war.

5. Our Naval Policy

Out of the Washington Conference there emerged for the first time in the history of our country, a definite naval policy, which has received national sanction. Instead of being opportunists from year to year, we now can point to a naval policy so closely linked to our national policies that not only may naval men know and more accurately forecast our naval needs, but our legislators better may understand and appropriate the funds necessary to maintain an adequate naval establishment, organized on a definite basis. As every naval man knows, it is not alone the size of a navy which counts; it is its composition; its organization; and its effectiveness.

In short, we have now a naval policy based on the treaty for the limitation of naval armaments. This in general and in substance is (quoting the words of our Secretary of the Navy):

> Having in view the terms of the treaty for the limitation of naval armaments it became necessary to adopt a general policy as to strength which would conform to the terms of that agreement. While it is true that the ratios adopted by the Conference were made to apply to capital ships and

airplase carriers only, the avy Department considered that it was the intention of the conferees that the ratio of 5:5:3 should apply to the relative total strengths of the navies concerned. It therefore adopted the following naval policy: to create, maintain and to operate a navy second to none and in conformity, with the ratios of capital ships established by the Treaty for the Limitation of Naval Armaments.

6. Conclusion

The most backward countries have never felt the need for navies nor for a merchant marine. They had nothing to give to the world. Those nations which have pursued a policy of isolation in international affairs have had no naval policies nor knew nor cared for what sea power means. Their national policies were internal, and naval policy and domestic policy are not close kin. But every nation, which at any period of its life, has embarked upon a career of world politics, had left the need for a navy adequate to support its national aims and its prestige. Naval policy and state policy have run side by side, or else the position and prestige of that state which failed to maintain the proper balance between the two, eventually fell. The Navy is first, the statesman's tool, and second, the warrior's weapon.

Our naval policy, established as the outcome of the Washington Conference, marks a new era in naval affairs. We have, unless forced to do so, deliberately refused to continue the competition in naval armaments, realizing that competition carried to extremes, inevitably leads to war. We have set, as we believe, just and fair proportions to naval strengths, when all factors entering into the interrelationships of foreign states, are weighed. We have, in one of the most delicate matters to adjust, at least partially effected a balance of naval power, and have gained the assent of the greatest sea power the world has ever known, in spirit and in principle, to our ideals. The establishment of a stable balance of sea power between the two great English speaking nations, will in the future, be regarded as one of the accomplishments of the century, for upon it, and upon the ideals of the countries holding this power in their hands, much of the safety and future progress of the world depends.

PREPARING THE ENGINEER DEPARTMENT FOR BATTLE

By Lieutenant Commander J. K. Esler, U. S. Navy

IT IS axiomatic that to have an efficient fighting unit, all parts of that unit must be co-ordinated to the best advantage. Ships may be grouped in divisions, and divisions into squadrons, but the fundamental fighting unit remains, as in the days of Nelson, the individual ship. All parts of this fundamental fighting unit must work together in perfect harmony to carry out their various functions in battle, to get the ship into position and maintain it there while using the battery as may be required by the nature of the engagement.

In the commendable effort to co-ordinate the activities of the various parts of the ship a new sort of exercise has been developed. This is the natural successor of the old "general quarters" of the days when the gun's crews maneuvered, as well as fought the ship. It is called by the same name. Some of the more fanatic enthusiasts are attempting to indoctrinate the rest of the service into calling it "battle-efficiency drill," but you can't camouflage a rose by changing its name. The drill is old in name and principle, and new only in its application to that part of the ship's equipment and personnel which are responsible for getting the ship into position for action and maintaining it there at all costs.

The most zealous advocates of the battle efficiency principle are unfortunately the men who see and think and are trained only for the gunnery end of the game. They are like men in a valley, whose view is limited to their immediate surroundings, except that in this case the converse is true, they are on the bridge, in the conning tower, or in the fire-control tower, with a wonderful view of the horizon, but with an armored deck between them and the essential requisites to get the ship into action and keep it there. They know they have only to signal for more speed in order to get it and some of them know no more about what happens below than the Irishman who said he didn't have to know what

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was inside a horse to be able to drive it. The difference is that the Irishman was honest enough to admit it.

A great deal of attention has been devoted to improvements in fire-control and battery, both in equipment and training, during the past few years, and battleship duty has become an almost never-ceasing exercise in gunnery training. Gunnery work predominates over other component requisites to the efficient fighting unit, and there is danger that, in the dominance of gunnery enthusiasm, other exercises just as important may be neglected. In matériel improvements engineering has kept pace with, or possibly has advanced more, than gunnery. But gunnery has monopolized the attention of the younger officers, and in the training of officer personnel has far out-stripped engineering. And if we strip the gunnery game of its camouflage of abbreviations, and special words and phrases, it will be found much less complicated, and to require much less technical knowledge and experience, than engineering. The application of technical training in ordnance is confined almost exclusively to the design and preparation of ordnance materials, and is not essential to the operation of battery or fire-control on board ship. On the other hand, technical training in engineering is of as great importance in the operation as in the design of machinery.

In the natural development of the present battle fleet more and more machinery has been added to ships. Gradually all this machinery has been turned over to the engineer department to keep in operating condition. The duties and responsibilities of the engineer officer have multiplied, until practically everything operated by steam or electricity, including fire-control equipment, special motors and lights, etc., used by the gunnery department, comes under his cognizance for maintenance.

It is fortunate that the Navy has some officers whose natural inclinations have led them to ignore the glittering promise of gunnery work for the more prosaic grind of engineering. It is due to these officers that ships are able to get into position for target practices, and perform such cruising as is required to carry out the gunnery schedule.

Anyone who is familiar with the ways and means necessary to make good in engineering work will, if he thinks about it at all, declare that it is a thankless, uphill task, full of hard work and

subterfuge. Not many young officers choose it, after a preliminary tour of duty below, and they avoid even their instruction tour of duty when possible. They feel that engineering work is time wasted from the real business of the Navy, which their training and association with other officers, lead them to believe is primarily the turret and fire-control work. As a consequence a very small percentage of the officers graduated from the Naval Academy during the war and subsequently, have qualified for engineering duty or have followed it sufficiently to warrant their being considered eligible for independent engineering assignments. Some of the younger officers who have been nominally in charge of the engineering plants of the destroyers since the war have gained valuable preliminary experience, and good material for training might be recruited from these officers.

The number of officers qualified for engineering duty of all kinds forms a very small percentage of the total number of line officers in the Navy, and this percentage is decreasing at an alarming rate. At the same time the present qualified engineer officers are being forced into other work to complete their record of duty performed prior to becoming eligible for selection. Many officers will probably point to the commanders and lieutenant commanders performing engineering duty only, in refutation of this statement. Some of them are really engineers, but few of them are available for duty on ships of the fleet. Such duty falls, in general, to the scattered few whose natural inclination for engineering work has led them to follow it.

Engineering in the Navy bids fair to become a lost art unless steps are taken to place it on an equal basis with gunnery work, and to instill the younger officers with the theoretical and practical knowledge necessary for the qualified engineer officer. A great step is being taken in the right direction in conducting the post-graduate school in engineering. The graduates of this school are, however, but a drop in the bucket in comparison with the total number of line officers. And unless they are permitted to perform engineering duties exclusively without injuring their chances of promotion, they should not in fairness to them, be retained continuously in engineering work. But in order that the present commanding officers can depend on having the ship respond to the slightest pressure on the accelerator, it is necessary that the

present engineer officers be retained because there are not sufficient qualified reliefs available for them. And if engineering in the Navy is to improve and keep pace with the advance in gunnery, these engineer officers must be given a free rein to maintain their machinery in condition for the demands of battle, and to train their men in such manner that the ship can be depended upon to get to the place of action and stay there.

There is a strong tendency on the part of some flag and commanding officers to include the engineer department with the deck divisions in drills and inspections, to an extent which seriously hampers the real work of the department. The fundamental purpose of the department is to maintain the matériel in efficient operating condition, and to train the personnel to handle it promptly and efficiently. The policy of the Bureau of Engineering in requiring that all possible repair and maintenance work be performed by ship's force affords a wonderful opportunity for training the engineering personnel, and insures experience, proficiency, and promptness in repairing damages incident to battle. It affords valuable training—provided—that conditions of operation and routine are such as to give time for this class of work. Much work cannot be done on machinery which is in operation, or when it may be required at any time without adequate notice. And men cannot be at their general quarters stations, at bag or hammock inspections, or scrubbing paintwork—and at the same time be overhauling boilers and other machinery.

A comprehensive, unbiased, estimate of the situation, would include a statement of what is to be accomplished, the men and material required, and the time necessary for its accomplishment. The engineer department, matériel and personnel, should be maintained in the superlative condition of readiness for action at all times. The main propulsive plant is of primary importance, and reliability and economy of operation of boilers and engines and their auxiliaries must not be accorded second place in any part of the preparation for action. Material for repairs by ship's force is always available upon application if the nature or extent of the work undertaken is such as to require expenditures greater than contemplated by the quarterly allowance for routine maintenance and upkeep. The men to do the work are available in the engineer department of the ship, if their time is not occupied with other

and less important activities. The operating schedule, including the time at anchor when repairs may be undertaken, and the availability of the men for work during such periods, determine what portion of the necessary repairs can be performed by ship's force. Major items of work cannot be undertaken without some assurance that time and men will be available for completing the job before the machinery is needed. There is practically no repair work on board ship which cannot be performed by ship's force provided time and men are available. This requires proper supervision of the work and an accurate estimate of time and material, together with a thorough knowledge of unusual conditions which are likely to delay the work.

The nature of the work required to keep the engineer department always in readiness to perform its function efficiently in action, requires that it be organized and conducted very much like a separate industrial department. Every engineer is the industrial manager of his department. In effect the organization of a ship resembles that of a navy yard or commercial industrial plant, with the commanding officer as the commandant of the yard or the president of the company. Neither of these officials would think of interfering in any way with the details of the industrial department.

It has been customary for the commanding officers of ships to inspect the crew at quarters at frequent intervals, and to have the engineer department shined up like a tropical lagoon in the moonlight at all times. The same officers may be detailed as commandants or even as managers of navy yards. They would not think of having the walls of the foundry or the boiler shop painted a scintillating white and scrubbed every few days. It would not occur to them to have the machine shop tools painted white or to have the moving parts bright steel work. There they realize the daily pay of each man in dollars and cents and can see his daily output of completed work. They would not for a moment countenance the employment of highly paid mechanics in shining hand-rails. They would even begrudge the time of the apprentices spent in the various trade schools. The clothing worn by the yard workmen would be of no importance, on duty or off duty, and as for bags and bedding—. Yet the problem of the industrial department on board ship is very much more like that of the navy yard than it is like

that of war ships in the days of "wooden ships and iron men." There is some ground for presuming that in changing the material of ships the entire saying may have become reversed. Did brightwork take precedence over matériel condition on ships in the war zone?

The old-timers who have forgotten their engineering experience, if they ever had any, will say this is nonsense, that ships must be kept spotlessly clean and bright in the interests of health, discipline, and morale. Those who may have had considerable experience in the days when the navy yards made practically all repairs and ships had heavy, slow-moving reciprocating engines and Scotch boilers will agree, and point to the wonderful advances made in speed and economy of operation in the past few years, without thinking of the changes which must have occurred in engineering installations to make this possible. And both will be right, in part, and both will be positive that they are absolutely right.

But no one can believe that the discipline or morale of the men is improved to any great extent by sitting around for hours at a time at a repair party, or loafing indolently around a hot fireroom watching a watertight door or a main drain valve, when they know very well that they will have to work late that night cleaning boilers or doing some other necessary work in preparation for getting underway or to keep the machinery operating satisfactorily. It speaks very well for the men that they do not complain of the additional work, and that they have enough interest in their own particular stations to resent being kept away from their work unnecessarily. And the engineer officer, if he is interested in his job, will not care particularly about standing around the engine room watching the air compressors eating up his multiple, and thinking of the work accumulating and the time to complete it getting rapidly less and less. There is not a great deal of satisfaction either, in being complimented on the appearance of the department at admiral's inspection, when he knows what lies underneath the silvery gleam on the surface. And he hardly appreciates the humor of the specially commendatory remarks as to the appearance of a pump which has not been in operating condition for months, or the remarks about lack of leaks in steam lines which have been cut out purposely for the inspection.

This outlines an extreme but not unusual condition. Granted that the department must be kept reasonably clean, it is still of greater importance that ashes be kept out of bilge suctions than that the steam gages be polished. It becomes a question of men and time, for it must be assumed that the engineer officer, with pride in his work and his station, will keep the men busy during such time as they are available, on the work in the order of its importance. And if he is being pestered about paintwork and brightwork, he is not to be blamed so very much if he gives that a place second only to being able to operate at all.

Some experienced engineer officers of the present day will probably say that if the engineer officer is on the job he can attend to both the overhaul and upkeep work as well as satisfy the most critical of inspectors. If they speak from experience, that experience is surely to be envied. They must have had a very pleasant duty, non-interference of drills and quarters, opportunities afforded by the operating schedule for maintenance and repair work, or the original excellent condition of the machinery which afforded a period of cessation from the usual maintenance activities until such time as some later engineer officer will have had to start at the beginning to rebuild the plant. These conditions must have existed, at least in part. And there is always the chance that their successors may not have been so fortunate. At any rate, their experience only goes to show what can be done under favorable conditions.

It is entirely possible to maintain an engineer department in efficient operating condition, to keep it reasonably clean and polished, and to carry out almost any operating schedule, and do all this with ship's force, even with less men than are usually assigned to the complement. Conditions must be such that the engineer officer can depend on using his entire force during working hours in port, and there must be a few available mechanics for repair work underway. But he must be free to plan the work, to assign the men to the most urgent jobs, and be able to count on having them for the full time necessary for the work. This requires an independent organization and routine, freedom from drills, quarters and other interferences. Why should the engineer department, with its work and purpose so entirely different from that of the deck divisions, be restricted to the same daily routine?

Those who direct the routine of ships evidently believe that all hands, including the barbers and boilermakers, and the yeomen in the flag office, turn out at 5:00 because the routine so directs. Also that they turn to at 5:30, get into clean whites for breakfast, attend quarters at 8:15 or 9:15 or whenever it is, and drill at battle stations until about 11:30. (They probably carry out the routine as regards breakfast.) It is quite possible that the framers of battleship routine did not even think of the engineer's force. As a matter of fact few if any ships require them to turn out at all hands, standardized routine to the contrary notwithstanding. Verily, one-half of the world does not know what the other half is doing. Some ships require all of the engineer's force not on watch or especially excused to attend quarters at the same time with the deck force. The time may be changed for a field day on deck, but never for work below. Practically all ships require the engineer's force to attend general quarters with the deck force, though some do not keep them at the battle stations very long. But maintenance and repair work is not to be done by fits and starts, a few minutes at a time. To be done properly and expeditiously it must be carried through to completion with as few interferences as possible.

The peace complement of battleships allows a watch in three for cruising and a watch in two at full power. A very simple arrangement for various conditions of readiness for action has been put in operation. It calls for a watch in two for general quarters, and a watch in four for other conditions. Ships exercise at shifting from one condition to another during general quarters. They even provide for meals at battle stations. Some day the engineer officer will report too promptly that the engineer department is ready for some one of these conditions. The designers of the bill should try for themselves to shift into a watch in four frequently for exercise, with the complement for a watch in three. Of course a very complicated arrangement of watches is posted conspicuously for admiral's inspection and removed before any of the men get a chance to study it and ask embarrassing questions. And in the meantime the engineer department goes on its way rejoicing and caring not nor knowing, how many bills are designed.

But why be bothered with all these subterfuges? Why hide men in boilers during inspections in order to get the work done?

Why pretend to be trying out the pumps at about 2:00 A. M. when in reality the ashes must be ejected if the ship is to get underway at full power the next morning? Why not recognize that the engineer department is every bit as important as the gunnery department, and accept the fact that it has a very important task entirely distinct from gunnery training? Operating schedules can be arranged to suit both departments. Cannot the two departments be developed independently according to the work they have to perform and the requirements of battle? Cannot their battle training be co-ordinated without following out the same daily routine, which hampers one department seriously?

The following tentative outline of a policy for engineer department routine and management is proposed for whatever it may be worth, and is based on considerable engineering and some gunnery experience under most of the conditions noted:

(1) At anchor—Have reveille for the engineer's force at 6:00 A. M., breakfast at 6:30 A. M., and turn to at 7:00 A. M. Keep separate mess tables for watch standers. Muster on stations at 7:00 A. M. and work until 11:30 A. M. Turn to at 1:00 P. M. and work until 4:00 P. M.

(2) Underway—All hands at 7:00 A. M. Breakfast at 7:30 A. M. Repair gangs muster on stations at 8:00 A. M. Watch standers muster at quarters at 9:15 A. M. or with deck force. Have battle drills with the deck force, to test out communications, watertight doors, etc., but do not require watch standers not on watch to go below. All officers in the engineer department go to battle stations, close watertight doors, test communications, man emergency stops, hold casualty drills, etc., with men on watch, mess cooks, compartment cleaners, and wash-room keepers as assigned to those stations. Men not on watch or turning to muster in compartments.

(3) In general—Have bag and hammock inspections, etc., underway as directed by the engineer officer to suit watches and work. Disregard engineer's force when piping scrub and wash clothes, aired bedding, etc. Assign a part of the rail to the engineer's force for aired bedding and let men put up their bedding and take it down as directed by the

engineer officer to suit watches and work. Set aside a place on deck for the engineer's force to loaf when off watch and during meal hours. Have them keep it clean if they persist in wearing steaming shoes on deck. Permit clean dungarees at meals and on deck except at official functions. Have the living and messing compartments of the engineer's force separate from the deck force, have engineer's force petty officers in direct charge, and have the engineer officer responsible for the discipline of the men and the condition of the messes and compartments.

(4) Special—Do not give external appearances any considerable weight at admiral's or commanding officer's inspections. Have inspections conducted frequently by experienced engineer officers, both at anchor and underway, under the direction of the Bureau of Engineering, and similar in character to the inspections by the Board of Inspection and Survey, reporting on the condition of the machinery rather than on its appearance. Arrange for as little interference with the work as possible during these inspections.

It is realized that very little change from standard practice is proposed, and that in a way not to interfere with the progress of gunnery training or with the co-ordination of the work of the two departments. The principal result would be to separate the work of the engineer department from other ship activities, to give the engineer's force a chance to carry on their own work without interference, and to make the engineer officer responsible for the condition of the machinery primarily, rather than its appearance. The idea of early breakfast and turn to in port is not original with the author, but was advocated by an officer with many years experience in battleships, both as engineer officer and as commanding officer. It is believed that engineering and gunnery activities can be co-ordinated sufficiently by drills at sea, without shifting watches for the purpose. The casualties which may be expected in the engineer department in action are identical with those which may develop at any time underway, in which case they would be handled by the officers and men on watch at the time. Casualties can be simulated much better underway than at anchor. But with

ships steaming at slow cruising speeds, even the steaming conditions which may be expected in action are difficult to simulate.

Engines and boilers and their auxiliaries are supposedly designed for operation at full power. No one can tell whether or not they are ready unless they are tried out frequently, and defects eliminated as they develop. To maintain machinery in condition for full power does not mean that it should be operated until it breaks down and has to be repaired. Very little repair work is required to keep the plant in excellent condition. Some machinery must be opened for examination before it shows any indication of being out of order. The engineer officer who waited until turbine and shaft bearings were below the danger point before taking leads or bridge gage readings would be out of luck at full power. Then again, an inexperienced engineer officer might consider a main feed pump in satisfactory operating condition when it might require a thorough overhaul, as would be evidenced by opening for examination. At present ships are given a full power run of four hours duration once a year. It is believed that this interval should be shortened to at least once a quarter. The later engineering plants should be able to stand full-power operation almost indefinitely without causing appreciable deterioration of the plant, provided that the machinery is maintained in proper operating condition.

Of the engineering casualties in the Navy, the most disastrous have occurred during full-power trials. They have been due in part to failure of the matériel to stand the strain of full power, and in part to inexperienced personnel. If full-power runs were made more frequently they would take on the aspect of routine procedure, officers and men would become more familiar with their duties under this condition, and casualties would become less frequent. The great importance at present attached to the full-power run, by reason of the penalty in engineering competition attached to the failure to complete the run, leads engineer officers to take chances that would not be considered in routine operation.

Moreover, operation at full power requires that all machinery be maintained in the best possible condition, and is the only real test which could be applied in times of peace to determine whether or not the ship is ready for its place in the line of battle, as of

course it should be at all times. The machinery is built for it, the men should be trained for it, and the cost of fuel should not be prohibitive when the benefits to be derived from frequent full-power runs are considered. If the expenditure for fuel for target practice is fixed, a compromise should be arranged with the Bureau of Ordnance allowing fewer runs at greater speed to keep within the fuel allowance. There are innumerable instances of bearings and thrusts burning out, and failure of necessary auxiliary machinery, at cruising speeds. It would not take long at full power to show up these defects, and if the call for full power for action should come unexpectedly, such ships would never get a chance to use their up-to-date gunnery equipment and their intensive gunnery training. The greatest benefit to be derived from frequent full-power runs, especially during target practices, is the training of the entire crew to operate under the conditions which may be expected in battle. Any ship which can steam at full power can steam at cruising speeds, but the converse of this is not necessarily true.

To summarize the requisites for readiness for action at all times in the engineer department of a battleship:

(1) Provide for a succession of qualified engineer officers by training younger officers.

(2) Provide a separate organization and routine for the engineer department.

(3) Have inspections made of the condition of machinery rather than its appearance.

(4) Operate at full power at least once a quarter, and more frequently if practicable.

SEA SERVICE MADE EASIER AND MORE EFFICIENT

By Captain A. W. Hinds, U. S. Navy

THE commander-in-chief of the battle fleet recently gave his division commanders and captains the privilege of criticizing certain important manuals used in our day's work while on duty at sea.

The admiral did not give us an order to send in these reports; had he done so, we might have growled at it as increased "paper work," of which there is more than enough to keep the average captain and his heads of department busy. He so worded the memorandum that those who felt that they might possibly help the sea-going officer by criticizing the manuals felt free to do so without "stepping on the toes" of those who issued the books.

In the old days in the Navy an officer did not dare send in any criticism of the way work was carried on unless the criticism was most evidently constructive. During the past decade, however, the Navy has grown so fast and the naval profession has changed so materially that those in the higher commands cannot possibly be familiar with all the details of the service manuals.

The manuals at which the admiral told us we might shoot were issued, of course, over the signature of the Secretary of the Navy or the Chief of Operations, but, as everybody knows neither the Secretary nor the Chief of Operations can know the contents of all the various manuals, I feel sure it will be understood that I am not criticizing the administration of the Navy in writing these notes.

Ordinarily an officer is satisfied when he completes an official letter suggesting ways and means to improve the efficiency of the service. He writes the letter, signs it, and "stands pat" under the disciplined impression that suggestion is the limit beyond which he dare not go and that it is up to his seniors to carry out the scheme for improvement or throw the letter in the wastebasket.

We are prone to resist change, however, and the revision of a

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manual in use in the Navy costs money and is hard work, so that many good suggestions die a natural death unless the majority of officers can be convinced that the suggestions have merit. For this reason some of the criticisms I made in answer to the invitation of the commander-in-chief of the battle fleet are submitted to the readers of the NAVAL INSTITUTE. They may convince no one there is any merit whatever in them, but there will at least be opportunity for more officers to see them than if passed along in the usual official channels.

The division commanders and battleship captains of the ships in the Pacific were invited to submit comment on many of the manuals used at present in the Navy. Due to lack of time and space, I will incorporate here the gist of notes on only three subjects, as they are of major importance compared to the others. These three are the *General Signal Book, Formations and Maneuvers of the Battle Line,* and *Radio Communication Instructions.*

As all three of the manuals to be discussed are of a confidential nature, it follows that only the most general discussion of them can take place in a magazine of such wide circulation among foreigners as the NAVAL INSTITUTE. This may have a tendency to prevent constructive criticism, but a remedy will be offered wherever practicable while still guarding carefully the confidential nature of the three books.

"THE GENERAL SIGNAL BOOK"

There is a spirit of competition in signaling, as in all the other branches of the naval profession, and competition is just as necessary in this branch as it is in gunnery or engineering. Being in competition with other ships, the tendency is to answer a flag hoist signal as soon as possible in order that the "Devil may not take the hindmost." This forms the strongest argument that all general signals—certainly those involving tactical movement—should be so simple and clear that there can be no chance of misinterpretation.

In our present general signals there are so many pasters showing changes and so many interlineations and explanations that it is difficult for the captain and the signal officer quickly to get at the "meat of the matter" in the flag hoist. In addition, there are

"ifs," "excepts," and "i. e.s" used, and these terms should have no place in a general signal book.

The use of a pennant "over" to mean one thing and "under" to mean another should be avoided. It is my understanding that this was borrowed from the British, whose officers and men specialize in signals. In our service captains, during the next few years at least, will have only short periods in command. In addition, both the signal and communication officers can afford only a short time in their respective billets if they are to become well grounded in all other branches of the naval profession. Neither signal nor communication officers can afford much over a year in the special duty. The "over" and "under" use of a pennant is not only confusing to what we may think of as green captains, signal and communication officers, but I have often seen flag lieutenants temporarily confused as to the "over" and "under" meaning. All these officers generally recover in time to keep the ship or division out of danger, yet the General Signal Book should be so simple and clear that there can be no chance for even temporary confusion. Why hold on to signals containing a possibility of confusion? In doing so, are we not making our work unnecessarily difficult? The suggested remedy is that *R* be hoisted to show the movement is to the right and *L* to show it is to the left. Where a three figure course is part of the hoist, the addition of *R* or *L* would make the hoist too long, but *R* or *L* could be shown at the same time in another hoist, and other flags could be substituted for *R* and *L* in the other uses of these flags in the *General Signal Book*.

There are places in the *General Signal Book* where the left hand part of the page may show squadron flag or division flag or section flag. Putting all these together under one bracket as is now done places an unnecessary load on the mind which, during maneuvers, is already burdened with many matters. Why not take a little more space in the book and give squadron flag with its signal and follow this by division flag with its signal, etc.? The simpler the better.

There are certain signals in the book involving a maneuver to be made on signal of execution, followed by another maneuver at some future and unknown time. I believe this to be an unnecessary burden on the mind of the officer charged with the division or ship movement. In order to make things easier for all con-

cerned, such signals should be avoided. Let the officer in tactical command signal his force what to do now—at signal of execution. At some future time he can have the force do whatever he wishes it to do.

A revision of the *General Signal Book* will be forced upon us soon on account of interlineations and pasters, if for no other reason. When the revision is made, all signals containing any possibility of confusion should be simplified, and great care should be taken with indexing and tabbing. Furthermore, the book should be revised by experienced officers fresh from sea duty detailed solely to the duty of revision. I doubt very much the value of revision of any service manual by a board of officers during a cruise. There are too many other things in the regular day's work to interfere and break the trend of thought.

"Formations and Maneuvers of the Battle Line"

This book is a great improvement on Standing Order Number Two, but there are still too many cruising formations. The more cruising formations we accept, the more there is for all hands to learn in order to be expert in going from each formation to each of the others. If we only needed to follow the diagram in the book properly to perform an evolution, then it would be simple, but there are adjustments to be made in nearly all the evolutions in order to be in the proper position at the end of the maneuver. These adjustments, such as turning more or less than called for by the book or keeping one course a longer or shorter time than the book directs, can only be learned by actual experience in performing the maneuver.

During tactical exercises the captains and division commanders learn how closely the rules can be followed and make notes, mental or otherwise, as to what to do in the future in similar cases. If we have many cruising formations, then it will be much more difficult for those concerned to handle the many varied situations than to handle the smaller number that will arise with much fewer cruising formations.

In the consideration of the necessity for few and simple maneuvers it must be constantly borne in mind that the next twenty years will probably be lean ones in money to spend in tactical exercises; that frequent changes in battleship captains and division com-

manders will take place; and that there is never enough time spent in tactical exercises to bring the personnel to the highest state of tactical efficiency. Do not these conditions make essential the reduction in the number of cruising formations in order that, even with lack of money and time, we may do the reduced number of tactical movements much better than we could do the many?

Is there objection to having, say, only two cruising formations, one for high and one for low visibility? Is there an absolute necessity for special cruising formations to cover special cases where the enemy is picked up on special bearings? The point will be made that two other naval powers have more cruisers than we and can, therefore, drive in our more numerous destroyers and deny us information, and that the enemy may appear on an undesirable bearing for us. Such a reason is no argument for an unnecessarily complicated tactical manual. The answer lies in more cruisers. Try as we will, we can never get away from the fact that type must be fought with type. In the long run, we shall be forced to have as many cruisers as any possible enemy, for there is no naval officer who will ever be willing to discount the value of information of the position and formation of the enemy, Eventually we may expect a limitation in cruisers, destroyers, and submarines, and a prompt appropriation by the United States for cruisers would probably force the limitation sooner than it would otherwise come. Granting us equality in means of obtaining information of the enemy, then there seems no reason why we should have more than two cruising formations, one for high and one for low visibility.

Reduction of the number of cruising formations to two would result in great simplicity, both in our tactical manual and *General Signal Book*. Furthermore, notwithstanding lack of money and time and short detail of captains and signal officers, we should probably be able to do the few maneuvers well instead of doing the many indifferently.

"Radio Communication Instructions"

I believe it will be generally conceded that our Navy has more trouble with radio communication than with any other branch of the naval profession.

Naturally an officer who has just finished a busy cruise in command of a battleship cannot discuss radio communication troubles from the standpoint of a radio expert. No one mind can carry the details of all branches of the service, and an officer of the rank of captain cannot be expected to give more than his general impressions with respect to our radio shortcomings. These impressions may be wrong in the present instance, still if these notes serve the purpose of stirring up a general interest in radio communication, the writer will be satisfied, for it is certain that when a great many officers in the Navy become convinced there is something wrong in the radio branch, the remedy will be found.

It is the opinion of the writer that we are trying to place on our radio personnel a load greater than they can carry.

In order to be an efficient radio operator a man should know:

(a) Commercial Traffic Regulations ..... 92 pages
(b) Part II of Communication Regulations .....131 pages
(c) Communication Instructions .....209 pages
(d) (In the Battle Fleet) Fleet Routine Orders 4, 5, 7 of 1921 and 1 of 1922 ..... 84 pages

(c) and (d) must be learned practically "by heart," and with the limited education possessed by the "run of the mine" radio operator, he simply cannot do it. We are damned by a procedure so complicated that it will never work successfully.

I believe the battleship I recently commanded stood near the middle in radio work. She certainly was not "wooden" and yet, notwithstanding all our radio school work aboard ship, we had only ONE operator we considered a master of radio procedure!

As an additional argument that our procedure is too complicated to work successfully, it is only necessary to state that trained operators from our shore stations require from six weeks' to six months' instruction in what they term "battleship procedure" before they are able to take a watch at the key.

If it be admitted that our procedure is so complicated that our operators cannot learn it, the point must not be lost sight of that we are now at peace and there is ample time for schools for radio personnel and that such schools are in operation and that radio details to ships are fairly stable. Our radio men learn a certain amount of the procedure up to the "saturation point" where they can commit no more to memory, and no further advance can be

hoped for until the procedure is simplified. We must give up the idea of deceiving the enemy by procedures; we have codes for that purpose.

It is certain that radio should be used in parallel with flag hoist in giving orders in battle. This was one of the secrets of successful maneuvering under fire by the Germans at the battle of Jutland. Our procedure is so awkward, however, that it is doubtful whether we could so use it. Suppose, for instance, the commander, battleship divisions, wishes to order by radio a turn of thirty degrees to the right. Under present procedure his radio operator would have to send fifty-two characters! Why not send something like T 3?

Any study of the effect of a procedure too complicated for successful use will be incomplete unless we try to visualize what will happen in the event of outbreak of war. So many ships will have to be commissioned that there will not only be a vast dilution of trained men in the radio detail to each ship, but we shall have such a small nucleus of radio men per ship that, to all intents and purposes, the radio detail will consist of green men. Those who served in the World War will remember how the gun crews of ships were practically wiped out on our battleships to man the guns of merchant vessels. They will also remember that we had as many as five thousand radio men at the radio school at Harvard University. In the war of the future we shall have just as difficult a problem to solve in manning our radio rooms, and the time will be too short for a green radio operator to commit to memory 516 pages of procedure, even were such mental gymnastics possible.

In the Navy we have, or should have, always in mind the thought of war, preparation for which is the major part of our duty. How can we best prepare our radio branch? I believe the answer to be:

(a) Cut the communication instructions drastically, converting the book into a primer which the ordinary enlisted man with no better than a high school education can understand and can commit to memory.

(b) Make the procedure just as near commercial procedure as practicable, for our radio recruits in war will come from both radio and telegraph operators ashore.

It is believed that all three of the manuals briefly discussed in this paper will be revised in the not distant future, and it is also my belief that any tendency toward simplification will have the sympathy of our senior officers—those who have the final say in the matter.

Much care should be used in indexing and tabbing the revised editions, for we frequently need to find things in a hurry. This feature of both "Formation and Maneuvers of the Battle Line," and the new book on "Scouting and Screening" is excellent.

The loose leaf system should be used so that pages can be replaced when extensive corrections need to be made. The monograph issued by the Office of Naval Intelligence 1 January, 1920, illustrates a loose leaf system rugged enough for use on the bridge.

As these three manuals are about the most important we have, the officers selected to revise them should be the best we have in the Navy for that particular work. At least one or two on each board should be officers of ample experience in the fleet. One member of each board should be an officer with the ability to write simple short sentences of short words. Long paragraphs set off by commas and semicolons, qualified by "ifs," "buts," "excepts," and "i. e.s" only make the subject matter more difficult to understand; and officers of and above the grade of lieutenant-commander have their hands more than full even now in trying to keep abreast the times in their work at sea. The books should be written "down" to the chief quartermaster rather than "up" to the flag lieutenant.

It is hardly necessary to suggest that the boards set to do the work should have that task only and not be distracted by other duties.

When these three manuals are revised and made as simple as it is possible to make them our sea duty will not only be easier, but we shall be more efficient, more ready to meet the huge naval expansion that must always come on the outbreak of war.

HANDLING 117 DE-COMMISSIONED DESTROYERS

By Lieutenant Commander B. F. Tilley, U. S. Navy

DUE to the decrease in authorized enlisted strength in the Navy in 1922, a large number of our new destroyers were de-commissioned at Philadelphia, Pa., and at San Diego, Cal.

There are now at Philadelphia ninety-three of the new destroyers and twenty-four older destroyers of the 750 and 1,000-ton classes, de-commissioned in 1919 and 1920. The new destroyers were laid up carefully by their own personnel in accordance with special detailed instructions from each bureau in the Navy Department. In view of the importance of keeping these boats fit for service, a description of the method of caring for them should prove interesting.

All destroyers at the Philadelphia Navy Yard are under the commandant of the navy yard. The manager of the navy yard is responsible for the material condition of the ships, and the captain of the yard is responsible for mooring, police service and fire protection. The equipage and stores are in the custody of the yard supply officer; certain items of equipage have been left on board each vessel.

The manager has the following officers engaged in preservation work on new destroyers:

1 Lieutenant commander, in charge, preservation superintendent (also in charge of all other de-commissioned ships).

4 Hull assistants, one for each group (warrant or ex-warrant officers).

4 Engineering assistants, one for each group (warrant or ex-warrant officers).

1 Ordnance assistant, an ex-gunner.

1 Extra line officer (available as relief for any of the above).

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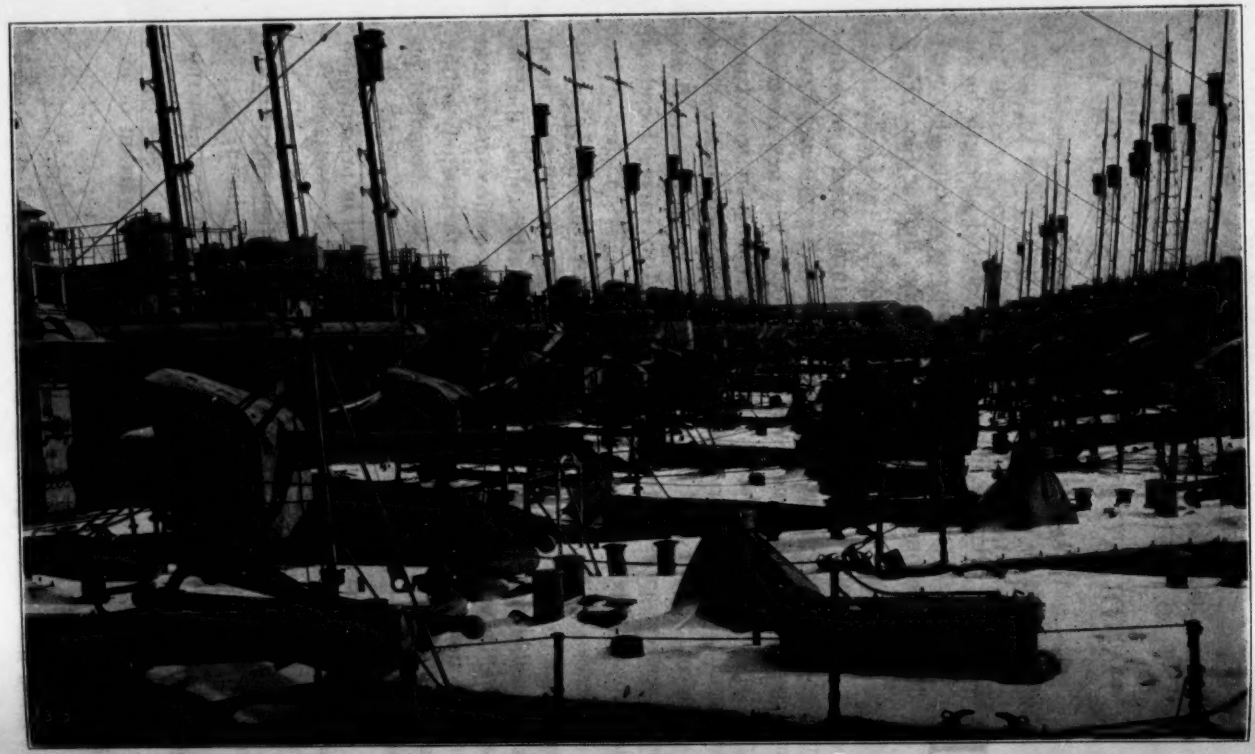

WEATHER PROTECTION OF U. S. DESTROYERS IN BACK CHANNEL. LOOKING EAST FROM FO'CSLE OF GOLDSBOROUGH, NAVY YARD, PHILADELPHIA, PA.

The ninety-three de-commissioned first line destroyers are divided into four groups for care and preservation purposes. The older twenty-four destroyers (twenty-one of the 750-ton type and three of the 1,000-ton type) with the *St. Louis* class of de-commissioned ships (eleven cruisers, oilers, colliers, etc.), form an extra group in the organization. Two additional officers are assigned to this extra group for engineering and construction and repair inspection duties.

The civilian force, who carry out necessary preservation work directly under officer assistants, average about thirty-five men to each group. These units are generally made up as follows:

2 machinists	2 boilermakers	
10 machinists' helpers	2 boilermakers' helpers	
1 electrician	2 shipfitters	
8 laborers	2 shipfitters' helpers	
1 rigger	1 pipefitter	not steadily employed with group
1 rigger's helper	1 painter	
1 ordnanceman	1 joiner	
2 ordnance helpers	1 joiner's helper	

Each inspection unit is organized to inspect and care for one destroyer in all departments each working day, four destroyers being simultaneously inspected each day, six days a week. This unit accomplishes necessary chipping and red-leading, drying out of tanks and bilges, small repairs, re-liming, jacking machinery, renewing preservatives, moving valves, and carrying out the regulations governing vessels out of commission.

This procedure provides for the inspection of each destroyer on an average of once every twenty-six days. The result of this inspection is recorded by inspection officers on special forms covering each item in the engineering (including radio and sound apparatus), construction and repair, navigation, and ordnance departments aboard the vessels. These industrial department forms are signed by inspection officers, examined, checked and approved by the preservation superintendent, and filed in the industrial department. Repair items necessary for preservation purposes appear on these reports and when accomplished are marked completed on these records. Once each quarter, a smooth report is made up from the monthly reports, for the Bureau of

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Engineering and Bureau of Construction and Repair; quarterly reports are not made to the Bureau of Ordnance. All torpedo tubes, guns (4-inch and 3-inch anti-aircraft), Y-guns, and depth charge releasing gear and racks are in position on each destroyer. Ordnance material is maintained in an excellent state of preservation. Breech blocks have been removed and stored in an ordnance storeroom in the navy yard. Copies of the "Laying Up and Recommissioning Machinery" and "Readiness for War Reports" of each destroyer are filed in preservation superintendent's office.

In addition to the thirty-five men detailed in each group, there is a repair force to handle work other than routine; several machinists, machinists' helpers, ordnance machinists, joiners and painters. This force has a workshop, fitted with benches, machine tools, woodworking machines, etc., located in the center of the four destroyer groups.

Building No. 425 (Old Submarine Base), is assigned as the destroyer base, and serves as a field office for inspection officers. Tool and material houses are conveniently located for each destroyer group. A special house is provided for handling unslacked lime, approximately twelve tons of unslacked lime per month being used during winter months for preservation purposes. The repair force is available to lift turbine casings, overhaul torpedo air compressors, free up valves, lift capstans, etc., and generally works out of step with the regular inspection units.

Major engineering jobs beyond the capacity of the preservation forces, such as renewing bearings, retubing condensers, etc., are handled by job orders taken up with the engineering and production superintendents of the industrial department, and are accomplished by the regular shop forces of the industrial department as funds and force permit.

The ninety-three new destroyers are moored in fresh water in double line between five piers on the south side of the Reserve Basin. Destroyers are secured bow to bow, with wire lines, bows interlapping closely, and separated by large wooden fenders. The older twenty-four boats are secured on the north side of the Reserve Basin. The arrangement of new destroyer groups is excellent for preservation purposes. Compressed air lines, and power and light circuits have been run across all weather decks

and this service is always available. Ships circuits are used in lighting for inspection purposes.

Destroyers have been kept cold this winter with good results, there being a minimum of condensation in the boats. Some sea valves have been boxed and boxes filled with saw dust, but the greater part of them have been wrapped with one layer of tar paper, one layer of 1½-inch hair felt, and a second layer of tar paper, the whole being frapped into the side with marline. In addition all sea valves are filled with paraffine, and when checked up and found only partly filled, preservation force has completely filled the space between valve and blank flange with paraffine, tallow or thick fuel oil. This method has proved adequate for protection of sea valves against freezing. All stern tubes have been filled with heavy fuel oil, and that part of the tube that is inboard has been covered with tar paper and felt. There were no casualties to sea valves or stern tubes on de-commissioned ships at the Philadelphia Navy Yard this winter. There are approximately 2,000 sea valves in these vessels. San Diego is not confronted with this problem.

Destroyers are kept weathertight at all times. All smoke stacks have been covered at top with usual canvas covers, and also with special sheet metal covers manufactured at the Philadelphia Navy Yard. Sheet metal covers are seized down tightly with wire to first jack stays on each stack. Bottoms of stacks have been closed in with painted or oiled canvas lashed close to deck. All engine room hatch covers have been specially secured by wooden strongbacks across the tops in addition to the usual closing devices.

Boilers are kept air-tight except during inspection of water sides. We have found it necessary to re-lime boilers every sixty days during the winter months, providing water sides are kept air tight during this interval of time.

Radio rooms, fresh water tanks, cofferdams, trimming tanks, compartments, etc., are inspected for condition of lime monthly, and re-limed about every second month as found necessary on inspection. Lime is renewed in turbines, exhaust trunks, condensers, evaporators and feed tanks as found necessary on monthly inspections.

All machinery is jacked monthly, and recoated with preservative as found necessary. All valves are moved monthly.

Anchor cranes, boat davits, sheaves, and stanchions are moved and oiled monthly to prevent freezing.

Radio rooms, radio compass rooms, galleys, chart houses, emergency cabins, torpedo work shops, ward rooms, and offices, are always locked except when inspected by an officer. There has been no loss from stealing due to this close officer supervision.

During the spring months, as the weather moderates, special work will be accomplished; tarring down all served rigging, slushing or coating with boiled oil all unserved rigging, lifting capstans for cleaning and reslushing of bearings and rollers, etc. All boilers will have fire sides cleaned and sprayed with fuel oil; spaces between outer and inner stacks will be cleaned and sprayed with fuel oil; turbines will be dried out by a special dry air apparatus now under test at the Philadelphia Yard, if found necessary (however, a number of turbines selected at random have had their casings lifted and have been found generally in very good condition); a great amount of scaling, chipping, red-leading, and painting will be accomplished both inside hulls and on weather decks and sides of each vessel, and last but not least, names and numbers will be freshly cut in on these fine destroyers, so that their identity will always be preserved.

The cost table published shows the cost of care and preservation per boat per month for the months of November and December, 1922, and January, 1923. In round numbers this important work is costing about $30,000 per month for all de-commissioned ships at the Philadelphia Navy Yard, approximately 140 vessels. This sum includes labor, indirect, material, and shipkeeper charges. There are approximately thirty-four shipkeepers chargeable to the new destroyer groups. Most of the destroyer shipkeepers are fleet reserve men, and consequently make most excellent material for this purpose.

Many officers from the Navy Department and the fleet have inspected the de-commissioned destroyers at Philadelphia since these vessels were placed out of commission in the summer of 1922. The consensus of opinion seems to be that these vessels are being maintained by the Philadelphia Navy Yard in the same material condition as when the destroyers were de-commissioned, and in better material condition than obtained at Charleston, S. C., where destroyers were steaming intermittently, and were manned

with the reduced reserve crews. The Board of Inspection and Survey inspects three destroyers at Philadelphia each month. A detailed report on the material condition and the equipage of each is made by the Board.

Destroyers are being dry-docked at regular intervals depending on length of time in salt and fresh water, according to a prearranged schedule submitted by the Navy Yard and approved by the Bureau of Construction and Repair.

It is significant to note that although temporarily de-commissioned, these fine new destroyers have their "fighting lights" still installed on each fore yardarm ready to "turn on" if it should become necessary.

AVERAGE MONTHLY EXPENDITURES FOR CARE AND PRESERVATION WORK (PER BOAT) ON DESTROYERS IN GROUPS LISTED. NAVY YARD, PHILADELPHIA, PA.

De-commissioned New Destroyers

Month	Group	Labor			Indirect			Material			Total		
		C. & R.	Eng.	Ord.	C. & R.	Eng.	Ord.	C. & R.	Eng.	Ord.	C. & R.	Eng.	Ord.
November 1922	A	55	78	13	25	33	6	6	12	2	86	123	21
	B	44	80	14	19	40	6	5	19	1	68	139	21
	C	80	87	20	37	42	9	6	8	1	123	137	30
	D	69	77	16	31	38	7	8	8	1	108	123	24
December 1922	A	79	105	14	23	44	6	16	35	–	118	184	20
	B	70	113	16	26	51	6	2	38	–	98	202	22
	C	98	66	17	29	29	6	6	26	–	133	121	23
	D	90	85	20	30	38	8	14	15	–	134	138	28
January 1923	A	93	73	17	22	25	6	5	4	1	120	102	24
	B	92	77	18	21	33	7	3	4	2	116	114	27
	C	118	61	19	28	27	7	7	4	0	153	92	26
	D	103	78	18	24	43	7	2	11	1	129	123	26

NOTE: Above charges include cost of shipkeepers after the middle of December. These shipkeeper charges average about $41 per ship per month.

THE PROTECTION OF CAPITAL SHIPS AGAINST POISON GAS

By Lieutenant Paul W. Hains (CC), U. S. Navy

IN 1917, during an action between German and British destroyers off the Belgian coast, the Germans laid down what appeared to be an ordinary smoke screen through which it was necessary for the English ships to proceed. Their flotilla leader, the *Botha,* had no sooner entered than her crew were overcome—the Germans had mixed in poison gas, or, more correctly speaking, toxic smoke of some kind. Entirely unprotected against such a weapon, the English suffered badly; and although the *Botha* passed entirely through the smoke screen in about a minute, in that short time every man on the ship was thrown into paroxysms of nausea and suffered a most violent headache, even for some time after.

It is not reported whether or not the Germans were victorious as a result of their using toxic smoke nor is this information important for our present purpose. The point to note is that poison gas has been used in at least one naval battle. And it can be used in other ways than by being mixed with a smoke screen. It can be dropped from airplanes in bombs; it can be projected upon an enemy in shells; it can be strewn in the path of an oncoming enemy by using floating containers which may be set off by a time fuse and which do not explode but emit the deadly gas slowly over a period of five minutes; it can be dropped from the stern of a retreating fleet to prevent pursuit; it can be sprayed from airplanes flying at low altitude far enough ahead of an enemy's fleet to be out of danger from gunfire and yet close enough for the spray to settle to the surface of the water just as the enemy reaches that point. Other means may be developed by foreign countries, about which today we know nothing.

And if poison gas can be used to work havoc upon an enemy's fleet, it will be so used. The United States Navy cannot afford to sit back in complacency, secure in the knowledge that

[Copyright: U. S. Naval Institute, Annapolis, Md.]

the Washington Peace Conference has abolished the use of gas in war. Actual gas protection must be provided our ships, in addition to the potential protection they now have. History has shown too often the impotency of an agreement, written or understood, when some nation's desires are thwarted by that agreement. When that nation, with whom we may be at war, believes that it can bend us to his will by using poison gas on our naval forces, it may help us little to recall to his mind an old agreement not to use gas. What we will need then is protection, positive and actual. Did Belgium fail to build forts around Brussels because Germany had agreed to keep out of Belgian domain? No, and the world is thankful. And that is the risk also that we cannot take. Of what then does the ideal protection for our Navy consist? It will be attempted only to describe a system for our battle ships. With modifications, the system can be applied to the other types of ships in the service.

Our fundamental requirement is that every man on the ship should be provided with and drilled in the use of a gas mask. There should be provided for men doing manual labor the type now found on certain battleships, having the canister carried on the wearer's head so as to permit free motion of the arms. Men who are required to speak in the performance of their duties should be provided with a diaphragm mask. Men wearing telephones should have an adapter to fit over the mouthpiece of the telephone and the diaphragm of their mask. No separate "telephone" mask is seriously needed. There should be provided what might be called an "optical" mask to be used by men required to sight the enemy. Pointers, trainers, rangefinder men, spotters, turret officers, etc., require this type. The mask should invariably be made an integral part of the sighting instrument, the eyepieces of the mask and of the instrument being combined into one piece. The canister should be carried on the optical instrument, so that the gas mask would be in all respects a part of the instrument. The angle tube of the mask should be fitted with a two-way valve, the manipulation of which should permit the wearer to breathe either directly from the atmosphere or through the canister, as necessity required. The advantages of this mask are twofold. First, the wearer would become highly efficient in its use, because he would have to use it at every drill.

Second, at a time of battle when a gas attack is expected, there would have to be no cessation in his duties—no need of taking his eye from the instrument, putting on and adjusting a gas mask, and then again picking up the enemy. Officers appreciate the difficulties of spotting, training, etc., under the most normal conditions. Imagine the multiplication of these difficulties when wearing a cumbersome gas mask which is not attached integrally to the telescope. Finally a combination of diaphragm and optical mask should be provided for spotters, rangefinders, and fire control officers. It is believed that these four types of mask fully cover the requirements of the service.

Not only must every man on board ship have his gas mask, but also he must be provided with protective clothing of some sort, clothing that will protect him against such vesicant fluids as mustard and lewisite. These fluids and their vapors cause no immediate burns when they impinge upon the skin and often require twelve hours or more to produce a casualty, and they therefore probably will never be used in a major engagement where immediate casualties are of more import. Nevertheless, they have an important use in the case of fleets lying at anchor or in the case of detached engagements where warships are used to cover landings or to bombard ports. A case in point occurred at Gallipoli during the World War. There, if the Turks had been able to sprinkle the British ships with mustard, using airplanes for the purpose, the British undertaking would have come to an abrupt halt, for the personnel of the British forces were not protected by impregnated clothing. Every man touched by the liquid would have been incapacitated to some degree. Every deck, and every gun that had been bathed with the chemical would have been out of commission for days, because of the horrible burns that would have resulted from walking on the one or manipulating the other. And another case is that of the use of mustard gas by the Germans on the British Fleet in Scapa Flow. Such a blow would have given the German Fleet immediate superiority on the high seas—their enemy being reduced from the mighty British Armada to the few ships that probably would have escaped the deluge of mustard.

The need for protective closing is there. Then the question is, should the clothing be a separate article for wear only at battle stations, or should it consist of a set of underclothing, shoes,

socks, trousers and blouses to be worn always when, in war, the fleet is in reasonable danger of being gassed with a vesicant agent? It is believed that the former type is far better suited to the requirements of the service for the following reasons: First, because this hooded overall would be worn only in action and at enough drills to get the "feel" of them, and would therefore outlast the other type which would very likely be worn at any old time the owner found his clean laundry supply getting low. Although impregnated clothing can be laundered the process after a few washings seriously reduces the protection the clothing can give against vesicant agents. Second, because it is easy for a divisional officer to see at *once* if his men are wearing protective clothing when a battle is imminent and if they are not doing so to enforce the rule. It would be far from a simple matter to inspect each man's undershirt and socks before going into action to see that he was properly gowned with the correct set. And this matter cannot be left to the men themselves. Their contempt for such a suit of clothing would be only too marked. Due to their ignorance regarding the horrible burns that occur when mustard gas or lewisite gets on a man's body, they would be prone to go into action as they felt most comfortable; and "damn the torpedoes—we'll take our chances with mustard." The hooded overall is a veritable signal that shows the desired information. With the ordinary clothing impregnated, an officer would have to content himself with warning his men that they ought to be wearing their impregnated outfit. And the third reason is that shoes, mittens, hood, and main body covering can be incorporated into one garment, giving complete protection, in the overall type, whereas, in the other case, separate mittens, shoes and hood must be on hand. In one case just 1,200 complete suits must be accounted for; in the other case 2,400 shoes, 2,400 mittens, 1,200 trousers, 1,200 shirts, 1,200 hoods, etc., must be looked after at all times in order to have them at hand when needed.

Although masks and protective clothing should be supplied for all men, the protection they afford should be resorted to only in a case of emergency. Other protection, protection to the compartments themselves, should be provided wherever possible. It is undesirable for men to have to wear their masks because their efficiency is thereby cut down, and especially is this true in the case

of men doing manual labor. The mask is cumbersome; it is difficult to breathe through for any length of time; and it produces considerable discomfort from perspiration and body heat. The amount of drop in a man's efficiency is a mooted question as it is a matter that does not lend itself to accurate calculation. But that there is a drop cannot be denied, nor can it be said that it is so small as to be negligible. The writer has played a game of baseball wearing a gas mask, and the heat, difficulty in breathing and general lack of "pep" were marked. He has likewise gone to the other extreme of writing while masked; and there also, though in a lesser degree, the same effects were produced. So we say that there is a loss in a man's efficiency. What does this mean on a ship?

It means that the rate of fire from the ship is going to be slower due to the cumulative drops in efficiency throughout the ship. The men in the powder and shell handling rooms do not get the ammunition to the hoists quite so fast; the loaders have just a little more lag in their work; the pointers, trainers, sight setters are all just a little slower at their work; and so on up the line. The result is bound to be felt. And therefore it is entirely reasonable to expect that the fleet which must go into battle with its men gas masked throughout, against an enemy unmasked but still fully protected, all other things being equal, is going to be defeated.

The consideration of this additional "compartment" protection is facilitated by dividing the battle stations on a ship into four types. In the first place there are those battle stations which are fully exposed to any kind of attack, gas included. Signal stations, the gun crews of anti-aircraft guns, first aid parties and miscellaneous transient personnel fall under this head. Second, there are such spaces, as turrets, secondary batteries, handling rooms and ammunition passageways all of which may be termed semi-closed, in that, although they are fully protected by armor and are even, some of them, deep in the bowels of the ship, yet they are not air-tight and cannot readily be made so due to the necessary passage of ammunition through them. Third, there are the fully closed spaces such as steering engine rooms, central stations, torpedo rooms, switch rooms, sick bays, distribution rooms, and radio rooms. Under this heading also are included fighting tops,

conning towers, plotting rooms and other spaces which, though normally not fully closed, could be made perfectly air-tight with modifications in their design. The fourth type of space embraces all spaces that have boilers or propelling machinery or its auxiliaries in them, dynamo rooms and evaporator rooms.

The personnel in the first, the fully exposed type of battle station, can be given no protection additional to that furnished by their masks and their protective clothing.

The men in the second type, the semi-closed type of battle station, constitute our hardest problem, and the one most demanding a solution—for these men furnish our offensive power. Briefly stated, the solution offered is this. To close all such spaces as tightly as possible, and to keep them under a small head of air pressure, the air being obtained from some sort of purifier. By keeping these spaces under pressure the contaminated air outside cannot get into them. Two sub-problems are encountered: First, how to make a turret or a secondary battery tight enough to enable a reasonable sized blower to keep the space under a few inches head of pressure; and second, what sort of air purifier is there that will remove chlorcetephenone chlorpicrin, phosgene, or chlorine gas from contaminated air. The complete details of the means by which a secondary battery can be made reasonably air-tight are quite impossible of any considerable amplification without its occupying undue space, but that such is possible we believe. Briefly the proposition would be to isolate each set of two guns in the secondary battery from the rest of the ship by decks or splinter bulkheads pierced only by water-tight doors. Such a scheme (possibly, however, not with the same goal in view) has been used on the Japanese battleship *Mutsu*. The gun ports of course could not be the open type we now have on the *Pennsylvania* and later ships. A development of the old type of sliding shield port would have to be used with, possibly, some sacrifice in resulting arc of train. The gun shield would have to fit the decks and the side of the ship snugly and be fitted with a sort of felt scraper. The opening in the shield for the gun would be closed by a gun buckler of some type and opening for sights minimized to the utmost. Turrets would be made tighter by inserting felt scrapers between the cylindrical shaped piece now used on the three gun, 14-inch turrets, and the turret front plate; by

minimizing the openings for trainers sights; by closing up completely the fifty odd one-inch holes in the overhang; and by providing felt sliding pieces between the barbette and the turret. The suggestions as here offered are crude, but they do point out the general scheme that it would be necessary to follow in order to make these semi-closed spaces tight enough to make possible the maintenance of a few pounds of air pressure within them.

The pressure required will not be great, just enough to prevent any wind that is likely to be met under battle conditions, from blowing the gas into the turret through the few openings that, of necessity, cannot be closed. If we assume a maximum wind velocity likely to be met in battle of twenty-five miles per hour, and a total projected area perpendicular to the wind direction of a few square inches, the necessary pressure within the turret will not be greater than about eight pounds per square foot, that is, one and one-half inches of water. Escape of air through the guns when the breeches are opened would not alter the effectiveness of this scheme of protection because the pressure of the wind outside when *high* would tend to lower the velocity of air escaping through the guns, and when *low* would not require such a high pressure as one and one-half inches inside the turret to keep the wind out.

So much for the tightness of semi-closed spaces and the necessary air pressure within them. The next step is to procure a purifier for the ventilating system of such spaces, and for this purpose the Seco Spray is recommended. This machine is a product of the Chemical Equipment Company of Chicago and finds its use in industry as a deodorizer, an evaporator, a gas cooler, a gas absorber, and an air washer. Its essential features are a horizontal revolving disk upon the top of which a liquid is continuously poured and by reason of the whirling motion of which the liquid is thrown out in a thin sheet or spray. On the underside of the disc are fan blades set at such an angle that any gas, which is fed in at the bottom and upwards to the middle of the fan, is whirled outward into the liquid spray. Surrounding the machine is a metal wall in the shape of a truncated cone. The gas and liquid are intimately mixed during the time of flight from disc to the wall. At the wall they are quickly separated by the action of impinging thereon and the gas passes out at the top and the liquid at the bottom. The machine is simply a mechanical

mixer and separator of a liquid and a gas. Now by using the proper alkali solution as the liquid and a given chemical warfare gas it becomes an excellent air purifier, suitable for our use in the Navy. A small laboratory machine at Edgewood Arsenal has successfully removed ninety-five per cent of various poisonous gases from contaminated air. The remaining five per cent it is hoped and fully expected can be removed by using an auxiliary disc and spray above the main one all enclosed in the same wall.

However, since the removal of this last five per cent of gas has not crystallized as yet, we will assume that the Seco Spray can remove only ninety-five per cent of the gases. This means that for the few minutes at the most, that a ship will be in a gas cloud the concentration necessary to produce lethal or lachrymatory effects in a turret must be twenty times the concentration required if there were no purifier. And such a concentration it is practically, if not absolutely, impossible to produce under "field" conditions at sea. And thus the Spray will serve our purpose.

The Seco Spray is built today for commercial use in three sizes up to capacity of 3,000 cubic feet of air per minute. A turret on a ship of the *Colorado* class requires less than 1,000 cubic feet of air per minute for ventilation. We then have a machine about as big as a turbo-blower on a destroyer to be fitted in each turret's ventilating system. This would not seem to offer an insurmountable problem to the designer. Moreover, the method here outlined of protecting semi-closed spaces is practicable, involves no radical change in design, and does not interfere with the efficient operation of machinery, guns or instruments.

The protection of the fully closed type of battle station, the third type, is rather more simple. Under this type are included the all important spaces, the fighting tops, the fire control stations, and the conning tower. These spaces readily lend themselves to being glassed in, where now open, and thus to being made perfectly gas tight. The scheme for all such places is to treat each one like a small submarine; completely to cut off any ventilating ducts that may be installed so that no gases can get in by any means so long as the compartment remains intact; and to keep the air inside pure. In this way the personnel could perform its duty under perfect conditions, unhampered by gas mask or protective clothing. When we cut off ventilation systems to these com-

partments it becomes necessary, of course, to have some sort of air revitalizing apparatus within each such compartment, an apparatus that will not only keep the carbon dioxide content of the air low and supply oxygen, but also keep the humidity relatively low, and the body odors of the occupants of the compartments from becoming obnoxious. Such an apparatus has been perfected and installed on a number of our submarines. It consists of a motor driven fan which sucks the air in the compartment up through a container filled with a specially prepared soda lime. In passing through this chemical all carbon dioxide is removed, water vapor above a certain reasonable amount, and also body odors caused by perspiration. A charge of forty pounds of soda lime will last for sixteen hours running continuously. Pure oxygen is liberated from tanks which in our case could be stood in a corner of the compartment or else tucked under a table or desk out of the way. In the report of experiments conducted by the American University Experimental Station in 1917 it is stated that the apparatus kept the carbon dioxide content down to less than one-half of one per cent when twenty-three men were confined in a submarine for forty-eight hours. At the end of the submergence the air was as pure as when the test started. Three charges of lime were used in the carbon dioxide removers, changes being made while the test was running. A little over six and one-half tanks of oxygen were consumed. This was for a forty-eight hour submergence, it will be borne in mind. The needs of a ship will probably never exceed a continuous run of twelve hours.

The method outlined here for protection of closed spaces should be extended to embrace as many compartments as possible. Spaces which may even require considerable change in the design of minor parts of them should be so protected. Its advantages lie in the complete independence of each compartment regarding its protection; the perfection of the protection; and the ease with which personnel therein can perform its duty.

The last type of space that requires consideration is that which embraces propelling machinery, electric generators, or heat machines such as the evaporators. It is not believed possible to provide purifiers in the ventilating systems in these compartments because the quantity of air required is too great. For instance, to refer again to the *Colorado* class each engine room requires 55,000

cubic feet per minute; and the evaporator rooms 6,000 cubic feet per minute. Even the smallest figure here would require two Seco Sprays, each of 3,000 cubic feet capacity and about five and one-fourth feet in diameter and four and one-half feet high. The largest figure would require forty such purifiers and a tremendously complicated system of air ducts. The question has at times been raised, why not use a very large canister similar to that our doughboys used as an air purifier. The reason is that one large enough to take care of the volume of air required would be about two-thirds as large as the ship itself. No such scheme can be used for engine rooms, or indeed for any other ventilation system. Nor can these spaces be protected by making them closed and gas tight for very obvious reasons. We are left then with the proposition that air, contaminated or not, must be used in vast quantities in the "black gang's" domain. How protect the personnel without forcing them to wear gas masks?

A system of inner compartments should be used, which should be made gas tight and be provided with submarine methods outlined above for air renovating. It should be provided with adequate glass windows, and to it should be led all pipes, valves, switches and levers through gas tight gaskets, necessary for the operation of the ship's compartment in which it is located. In short, each fireroom, engine room, motor room, generator room would have within it a central operating station, glassed in and air tight, within which the personnel could be housed in perfect protection and still perform their duties. Then the ordinary blower system for supplying the necessary air to engines, boilers and generators, would be operated as usual. By such a system the men could work at maximum efficiency without the necessity of wearing masks or protective clothing.

It is realized that the ideas set forth in this attempt to bring "GAS" to the attention of the service are far from complete and not above criticism. If the article succeeds in starting just one or two wardroom arguments, our desire will have been realized; for the truth of the matter is that the service is too prone to minimizing the danger from gas, or, what is worse, not to give the subject much thought at all.

HOW TO WRITE A SCIENTIFIC ARTICLE[1]

By Dr. C. Alphonso Smith, Head of Department of English, U. S. Naval Academy

The Five Essentials

I. Statement of your task or problem:

(a) Do not put pen to paper till you have bounded your theme north, east, south, and west. Whether your topic is assigned you or emerges as a problem from your work, "*What* I am to do" must precede "*How* I am to do it." Do not be content to think through your problem; put it into words. Nothing is known clearly till it is expressed clearly. "An engineer who is inarticulate," it has been said, "is quite as useless as one who is professionally incompetent." Inarticulateness is always a kind of incompetence, especially when a writer is trying to formulate the central purpose of a proposed article. Writing a scientific article is like waging war. In his *Principles of War* General Foch says: "In the presence of every question considered independently and by itself, ask yourselves first: *What is the objective?*"

(b) Such beginnings as, "It is my purpose in the following article" or "In the discussion that follows I have endeavored" or "One of the most interesting problems in naval construction is that which concerns itself with," will help to clarify your thought. But if you are certain of your final results you may state your problem not as a subject about to be investigated but as a demonstration already established. Huxley thus summarizes the conviction arrived at in writing *Man's Place in Nature:* "Without question, the mode of origin and the early stages of the development of man are identical with those of the animals immediately below him in the scale; without a doubt in these respects, he is far nearer the apes than the apes are to the dog."

(c) You will find it a stimulating exercise to collect examples from scientific articles of what seem to you model statements of task or problem. If the author has not summarized in a single

[1] Outline of lecture delivered at Postgraduate School.

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paragraph his main purpose, see if you cannot make such a summary yourself. Such an exercise will prove as good a discipline in logical thinking as in apt expression. The best way to learn to write is not to depend on rhetorics or composition books but to go at once to the masterpieces themselves. When you form this habit, your success as a writer is assured. Read and re-read the first paragraph of Macaulay's *History of England*. It is probably the best example in literature of a masterly statement of task or problem.

II. Gathering your data:

(a) With your problem firmly grasped you will be surprised to see how rapidly your data will accumulate. Results apparently irrelevant and phenomena seemingly unrelated will be found to converge directly upon your task. The first hint of the law of gravitation came to Newton when an apple fell upon his head. A man who had tumbled from a high building said: "In the course of my fall I was not conscious of any force pulling me down"; Einstein heard the remark and the theory of relativity was born. It is not from the number or novelty of phenomena that great discoveries come; they are dependent on the degree to which the mind of the investigator has been previously fertilized.

(b) Books, journals, and conversation with your classmates are excellent means of securing data. Many hints will come to you as you try to explain difficulties to others or seek to answer their random objections. Remember that it is patience rather than genius that makes the great investigator. Darwin ascribed his success not to superior intelligence but to "industry in observing and collecting data."

(c) Pay special attention to the phenomena that contradict your results. These rebels will become your best allies when you have conquered them. Lawyers stress only the testimony that supports their view of the case; but scientists are not trying to win over a jury; they are trying to get at the ultimate and unchanging truth.

III. Sorting your data: selection and rejection:

(a) The art of writing is the art of omitting. You are not building your final article now but you are selecting from a mass of notes those data and only those that help along your big central

idea. Sentences prettily turned and facts interesting in themselves must be ruthlessly sacrificed if they are not relevant. The art of condensing is the art of knowing the relevant and discarding the irrelevant. You have evolved a principle now and your building blocks must be sorted with the sole purpose of showing unity in apparent diversity.

(b) It will help you to remember that for twenty years, from 1839-59, Darwin was sorting his material for *The Origin of Species.*

IV. Organization of your material:

(a) You are actually composing now and some sort of outline is essential. The following advice is proffered by the American Institute of Electrical Engineers: "The task of preparing a technical paper is greatly lightened by constructing and following a well-considered plan, and no writer should undertake to prepare a paper without first preparing a definite plan upon which his paper is to be constructed. The simplest way to do this is to make an outline or skeleton of the paper similar to a table of contents, using a separate heading for each main division of the subject and appropriate sub-heads under each heading to cover sub-divisions of the subject. This affords a ready means of arranging the contents of the paper in logical order, and the actual writing of the paper consists merely in filling in one or more paragraphs under each head."

(b) Make a mechanical model if possible. It was Lord Kelvin's method. His biographer says: "One characteristic of all Lord Kelvin's teaching was his peculiar fondness for illustrating recondite notions by models . . . . 'I can never satisfy myself,' he says, 'until I can make a mechanical model of a thing. If I can make a mechanical model, I can understand it. As long as I cannot make a mechanical model all the way through, I cannot understand it.'"

(c) If a mechanical model is impossible, use diagrams, drawings, curves, and graphical representations wherever clearness demands them. Remember that seventy-five per cent of our knowledge comes through the eye. A helpful book is *Graphic Methods for Presenting Facts* by W. C. Brinton (1914).

(d) In every page that you write remember that the paragraph, not the sentence, is the unit of composition. The paragraph is a cluster of co-operative sentences making clear a single thought. Every good piece of prose writing is a chain in which the successive links are paragraphs. The art of using language effectively is the art of building and joining paragraphs. The new evaluation of the paragraph has transformed the teaching of English composition in all up-to-date schools. The old advice was, "Say it with sentences"; now it is, "Say it with paragraphs." But do not use too many paragraphs. They should follow the natural cleavages in your thought. There are no fixed rules. Find your models in the best works that you read. To cultivate a feeling for the paragraph is to lay a secure foundation for good writing.

V. Testing the whole by use and application:

(a) Your article is finished now but leave it in soak for a while. Important changes, re-orderings, omissions, and additions will surely suggest themselves. Do not turn it in yet. Above all beware of premature publication. "I gained much by my delay in publishing," says Darwin. Edison's biographer remarks: "I have often felt that Mr. Edison got himself purposely into trouble by premature publication and otherwise, so that he would have a full incentive to get himself out of the trouble." There are higher incentives in research than that of getting out of trouble.

(b) Practice a kind of dismissal and recall. That is, clear your mind of your article, expel it, and after a few days re-call it. It will come back to you shorn of its non-essentials. You have been so absorbed in it that you could not appraise it as an impartial spectator. You will now see it as a whole better than before. Make every correction suggested by the first rapid re-reading.

(c) In this quick re-survey of the completed article, compare especially the beginning with the ending. These are the two strategic parts of every well-written article. Do they harmonize? Do not the first few paragraphs need to be re-written? Did you not forget your beginning as you went deeper into the actual solution of your problem? Do not your final results compel a re-statement of your initial purpose? If not, you are both a trained investigator and a disciplined writer. Congratulations!

THE STRATEGY AND LOGISTICS OF THE DARDANELLES CAMPAIGN

By Commander Walter S. Anderson, U. S. Navy

Introductory

SEPARATING Europe from Asia, and connecting the Black Sea with the Aegean, is a three-part waterway about two hundred miles long. Its northern extremity, opening out from the Black Sea, is narrow and high shored, and about twenty miles long. It is called the Bosphorus. The large central portion opens out to a width of sixty miles, forming the Sea of Marmora. The western end, opening into the Aegean, is about four miles wide and forty miles long. It is known as the Dardanelles (the classic Hellespont).

On the northwestern shore of the Bosphorus, where it opens out into the Sea of Marmora, is the City of Constantinople. Opposite Constantinople is the City of Scutari, on the Asiatic side. Tradition has it that in the Eighth Century Haroun-al-Raschid looked from the heights of Scutari at the fair city of Constantinople and lusted to possess her. This desire burned in the breasts of the Ottoman Turks urging them on until finally in 1453, the Byzantine Empire fell before the onslaughts of the Turks, and they captured Constantinople, which they have held until recent times. Just now it is in the possession of the Allies, with its ultimate disposition undetermined.

It is hard to conceive of a better example of a strategic waterway than the Bosphorus-Marmora-Dardanelles one, at the same time communication between the Black Sea littoral and back country, and the Mediterranean, and obstacle or bridge, as the case might be, between Europe and Asia.

That this has been appreciated from the earliest times is evident. In legendary times, perhaps about 1200 B. C., the Greeks fought valiantly on the south shore of the Hellespont (Dardanelles) in their siege of Troy. Unsuccessful for ten years, they

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finally succeeded in taking the city by the famous strategem of the Wooden Horse. Here we had Greece attacking Asia Minor. But first one and then the other was the aggressor.

In 493 B. C., Darius dispatched against the Thracians a great expedition by the water route across the Aegean. It came to grief partly because the fleet was destroyed in a great storm, like another Armada of a later date. Again Darius attempted the conquest of Greece, only to be repulsed at Marathon (490 B. C.). His son Xerxes, after ten years of tremendous preparation, including bridging the Hellespont with two pontoon bridges, and renewing them after their destruction by storm, dispatched a great army across the Hellespont for a third attempt to conquer Greece. The train passed by one bridge, the army proper, by the other. Heredotus says "That for seven days and seven nights the bridges groaned beneath the living tide that Asia was pouring into Europe." In spite of their heroism at the Pass of Thermopylae the Greeks were defeated, and Athens was burned. However, by the defeat of the Persian Fleet at Salamis, the Greeks freed themselves of their invaders. His fleet having been destroyed, Xerxes feared for his communications. He saw his Hellespontine bridges in danger, and at once began an ignominious retreat. The remnants of his forces left behind were destroyed the next year on the same day, the army at Plataea and the navy at Mycale (479 B. C.).

Continuing preparations started by his father, Philip of Macedon, in 334 B. C., Alexander the Great crossed the Hellespont for a successful invasion of Persia and the East. And so it went, until the fatal Asiatic back-wash of 1453. Are the modern Greeks, in their present operations in Asia Minor, again to defeat Asia personified by the Turks, and free Europe of their blighting presence?

That the Allies, now that they manifestly have that power, have not done so, is no indication of their love for the Turks, but springs from complex considerations, not the least of which is their appreciation of the enormous strategic importance of Constantinople and its waterway, and their inability to decide to what country such a priceless heirloom should fall on the final departure from Europe of the unspeakable Turks. That a European treaty of 1841, reaffirmed in 1871 and 1879, specified that

none but a Turkish warship should pass the Dardanelles without the consent of Turkey, sprang not from the power of Turkey, or Europe's consideration for her, but from England's appreciation that her long line of communications to Egypt and India was open on the flank to an attack from the enemy she most feared, Russia, unless the Dardanelles were closed.

It was a curious twist in the thread of destiny that this throttling of Russia, so carefully planned by England, should at last arise to confound England. When in the death grapple of the World War Russia sorely needed munitions, and likewise needed to export South Russia's grain to hungry Europe for credit needed by Russia, Turkey at Constantinople, working for their new masters, the Germans, forbade the passage. No doubt the Turk smiled grimly.

Descriptive

The Dardanelles is a strait built by nature for defense. Forty miles long, never more than five miles wide, it narrows in several places, at two of them to but little over a mile. The general trend of the strait is north-east and south-west, but at Chanak, thirteen miles inside the western entrance, it turns to the north for five miles, just as if nature realized that provision should be made for gun positions to give a raking fire down toward the entrance. Furthermore, a swift current runs toward the Aegean, bearing down upon an attacker, fireships, mines, or whatever the infernal machine of the times may be, and reducing the invaders' entering speed. Not to stop until the task had been completed properly, nature flanked the Dardanelles with steep and high shores; the northern shore being especially precipitous. Heights of several hundred feet are found within a few hundred yards of the water's edge. On both sides the land rises rapidly, on the south side to three thousand feet at a distance of nine miles from the water's edge.

The heights to the northward are part of the Gallipoli Peninsula, long, and comparatively narrow (greatest width eleven miles). This peninsula flanks the Dardanelles to the northward for its entire length. It narrows to an isthmus of four miles at Bulair, where the Dardanelles opens out into the Marmora Sea. The Gallipoli Peninsula has as a backbone a ridge a thousand feet high. The country is broken and difficult. Its heights are

so much nearer the Strait and so much more continuous that it commands the Strait and opposite shore. Having had the privilege of observing it (from a ship) the writer can testify that from a potential attacker's viewpoint it is a most impressive sight, and agrees with General Sir Ian Hamilton in his written remark to Lord Kitchener:

"Here, at present, Gallipoli looks a much tougher nut to crack than it did over the map in your office." (H. to K., March 18, 1915).

At the south-western tip of the Gallipoli Peninsula, that is, at the northern entrance of the Dardanelles, is Cape Hellas. This location is also the same as Sedd-el-Bahr. Five miles northeast is Achi-Babi, 709 feet high, the commanding height at the southern end of the backbone ridge. Further along, thirteen miles from Cape Hellas, is the height of Kilid Bahr (653 feet), commanding the Narrows at Chanak.

Fourteen miles up the western (Aegean) coast of the Peninsula is the position now known as Anzac Cove. Three miles northeast of Anzac Cove is the height of Sari Bair (971 feet), the commanding height for miles around. It therefore lies eight miles north by west of Kilid Bahr.

Eighteen miles to the northward of Cape Hellas on the Aegean coast of the Peninsula is Suvla Bay. It is therefore five miles northwest of Sari Bair. The Suvla region is unique in that for about two or three miles inland the land is comparatively low and level, about two square miles being covered, however, by a salt lake.

From all this we see that Constantinople's waterway, in addition to having a strategic position, has that priceless and less usual strategic asset, great natural strength.

More Recent History

In 1807, Admiral Sir John Duckworth took his squadron up off Constantinople in the face of opposition to his passage of the Dardanelles. His casualties were comparatively slight, sixty killed and wounded, and small damage done to his ships, and this in spite of the fact that the Admiral had to lie off the entrance of the Dardanelles several weeks waiting for a favoring wind to take him up against the current, thus giving the Turks warning.

However, in those days the Turks did not have their efficient task-masters, the Germans, though the French, who then controlled the Turks, were energetic in making the Admiral's stay off Constantinople and return passage hazardous, by hurrying work on the coast batteries and marshaling gunboats.

There was no plan, and no supporting troops, and the Admiral withdrew in ten days in the face of the growing menace. His losses in killed and wounded, and damage to his ships on going out the Dardanelles were heavy. So ended an abortive expedition.

In 1878, Admiral Hornby made a naval demonstration off Constantinople with the consent of the Ottoman Government. He wrote a report on the difficulty of the passage.

In 1906, the possibility of a joint military and naval attack on the Dardanelles was considered by the British Committee of Imperial Defense. A memo on the subject drawn up by the General Staff of the War Office for the Committee's consideration included the following paragraph:

> The successful conclusion of a military enterprise directed against the Gallipoli Peninsula must hinge upon the ability of the Fleet not only to dominate the Turkish defenses with gunfire, and crush their field troops during that period of helplessness which exists while an army is in actual process of disembarkation, but also to cover the advance of the troops once ashore until they gain a firm foothold, and establish themselves upon the high ground in rear of the coast defenses of the Dardanelles. However brilliant as a combination of war, and however fruitful in its consequences such an operation would be were it crowned with success, the General Staff, in view of the risks involved, are not prepared to recommend its being attempted.

Another paragraph read:

> Military opinion, looking at the question from the point of view of coast defense, will be in entire agreement with the naval view that unaided action by the Fleet, bearing in mind the risks involved, is much to be deprecated.

The Director of Naval Intelligence (1906) generally agreed with the foregoing, but thought fleet gunfire could assist the landing more than the War Staff believed it could.

The Inception of the Campaign

Turkey declared war October 31, 1914.

On November 13 following, the British Mediterranean Squadron bombarded the outer forts for ten minutes, to test out the

range of the Turkish guns. This bombardment was ordered by the Admiralty without having referred the matter to the War Council. Not just because subsequent events proved this to have been a mistake, but abstractly, this was a most unwise action to take. It was obvious that some effort might at some time during the war have to be made at the Dardanelles, and any action indicating interest in an objective prematurely, naturally warns an enemy to some extent, and "fore-warned is fore-armed."

An attack on the Dardanelles was first advocated at the War Council by the First Lord of the Admiralty, Winston Churchill, on November 25, 1914. The objects to be obtained by capture of Constantinople were:

(a) To relieve the pressure on the Russians in the Caucasus.
(b) To deter Bulgaria from joining the Central Powers.
(c) To admit needed munitions to Russia.
(d) To release Russian grain and give her credit.
(e) To give access to the Danube.
(f) To settle a perennial European trouble.

These objects were of very great importance, and one cannot take issue with the decision of high policy that something should be done to realize them. Where the policy merges off into the strategy of accomplishment there cannot be the same unanimity of opinion.

It was expected and maintained by Churchill that, in view of the short resistance the strong Belgian forts of Namur and Liege were able to show the Germans' mobile heavy artillery, the forts of the Dardanelles would be similarly vulnerable to the artillery of the fleet. He was the more confirmed in this view on account of the great development in naval artillery, as exemplified in the *Queen Elizabeth*, with her fifteen-inch guns, and on account of the development of aircraft, with the additional possibilities of accurately directing gunfire which they afforded.

There can be no doubt that Churchill was the driving force behind the Dardanelles attack; he advocated a naval attack. He showed a remarkable and ill-considered determination in advocating this against the belief of his principal technical adviser, Lord Fisher, the First Lord of the Admiralty. In the report of the Dardanelles Commission they dwell at some length upon the

fact that the technical advisers, who were present at the meetings of the War Council, where the Dardanelles Operation was under consideration, did not speak out their opposition, notwithstanding that they were not themselves members of the Council, and that they were in the presence of their Chiefs, who were members, and *who knew their views.* This seems to be beside the mark. No reasonable man can doubt that it was well known to all concerned, *who believed the operation should be undertaken,* and who were contrary minded.

If it had not been known before, none could have remained in ignorance after Lord Fisher's starting to leave the Council Meeting, and only returning after Lord Kitchener followed him and urged him not to go on out. If the Members of the Council would infer that Churchill's technical advisers were in accord with him by his advocacy of the operation, so much more was it the duty of Churchill explicitly to inform his colleagues of the Council that such was not the the case.

As a result of representations from the Russians that a diversion should be created in their favor, as they were hard pressed, the British on January 3, 1915, made a commitment to them that they would make a demonstration against the Turks; the locality was not specified.

In a War Council meeting January 8, 1915, Lord Kitchener expressed himself as tentatively in favor of a joint attack on the Dardanelles, and said he estimated it would require 150,000 men to capture it. He reserved his final opinion until a close study had been made.

In all the considerations of the project, by the War Council, and they were none too analytical, all seemed to favor a joint attack, and yet, as General Callwell subsequently testified, "We drifted into the big military attack." The decisions were not clear cut. And the Staffs concerned did not bestir themselves as they should have with such decisions as were made and make plans, or by their failure to make feasible attempted plans, show up the impracticability of the decisions.

Naval Attacks Decided Upon

At any rate it was decided by the War Council January 13, 1915, that:

The Admiralty should prepare for a naval expedition in February, to

bombard and take the Gallipoli Peninsula, with Constantinople as its objective.

The idea was that the attack would be purely naval, and could be broken off without loss of prestige. The plan was definitely confirmed January 28, with the addition that troops were to be used for minor operations only.

Then February 16, it was decided to mass large bodies of troops in the neighborhood of the Dardanelles for further operations after the Fleet had forced the passage.

The Home authorities were warned as to the strength of Gallipoli while the operations were under consideration, by Generals Maxwell and Birdwood in Egypt, and by the French Colonel Maucorps, who had been military attaché at Constantinople.

Vice Admiral Carden was in command of the Mediterranean Squadron.

On February 19, he bombarded the outer forts of the Dardanelles. The results were pretty well summed up in the following extracts from his report of March 17.

The result of the day's action on February 19, showed apparently that the effect of long range bombardment by direct fire on modern earthwork forts is slight. Forts 1—4 appeared to be hit on many occasions by 12-inch common shell well placed; but when the ships closed in all four guns opened fire. And on the second day, although a heavy and prolonged fire at short range was poured into the forts, 70 per cent of the heavy guns were found to be in a serviceable condition when the demolition parties landed.

In the meantime, Kitchener, worrying about conditions in France, held up the troops for the Gallipoli neighborhood, and transports which could have sailed February 22, were not permitted to sail until March 16.

On March 11 Churchill sent Carden a message urging action and promising support in case of losses, which would have to be accepted. While Admiral Carden was replying to the message with the seaman's "Aye, aye," there is some doubt as to his being optimistic, particularly after his experience of the slight damage his bombardment of February 19 had effected. He resigned March 16, on account of ill health, and was succeeded by Vice Admiral De Robeck.

Then followed the *bombardment of March 18, 1915.* This is an important date in this operation. The losses were heavy.

Sixteen heavy ships, British and French, made a joint attack on the forts. The battleships *Irresistible, Ocean* and *Bouvet* were sunk. Almost all the latter's crew were lost. Four other battleships were so seriously damaged that they had to be docked. Probably these ships were sunk and damaged by floating mines. De Robeck reported them as a big menace that in subsequent operations he would have to make special provision against.

Meanwhile on March 13, 1915, General Sir Ian Hamilton was appointed to command the troops forming the Dardanelles Expedition. His instructions contained, among others, the following provisions:

(a) Only to use large military forces if the Fleet failed after making every effort.

(b) Before a serious military effort to assemble all forces.

(c) There was to be no abandonment, and there must be no check.

(d) Minor operations were permissible, but subject to various restrictions.

General Hamilton was sent off with no proper preparation having been made. There was no general plan or scheme of operation. Information and correct charts were lacking. Water supply had not been provided for. He was not even given a copy of the War Staff memo of 1906. As he testified: "There was a great want of Staff preparation."

In the earlier plans, such as they were, the base of operations chosen was Lemnos, an island forty miles west of the Dardanelles entrance. Its principal port is Mudros, on a bay of the same name. Use was also made of the island of Imbros, thirty miles northeast of Mudros. Due to lack of water and port facilities, such as appliances for unloading and loading, and the necessity of repacking the transports, the main base was changed on March 18, to Alexandria, 580 miles from the Dardanelles' western entrance. Thereafter Lemnos was the advanced base. (Malta, by the way, was 700 miles away.)

The repacking of transports was due to there being no general plan of operations when they were loaded, and also to the following:

(a) First line transport was not always sent with the troops.

(b) Unnecessary mechanical transport was sent.

(c) Some units were unnecessarily broken up.

(d) Some bad stowage.

The repacking was done in Alexandria, March 18 to April 16. The Dardanelles Commission was of the opinion that the effects of this requiring to repack were not serious, as the landing was April 25.

General Hamilton arrived at Mudros, March 17, with his General Staff, but his Administrative Staff was separated from him, being at Alexandria, where it arrived April 7. Due to this separation certain members of the Administrative Staff stated that they were embarrassed in their work, due to lack of co-ordinating information of intended operations, particularly the Director of the Medical Service.

Upon arrival Hamilton made a reconnaissance of the beach from a boat. He was further informed in conference by De Robeck: That thousands of Turks were working nights upon trenches, redoubts and entanglements. That they were never seen, but the results of their labors could be seen. That the landing places were commanded by trenches and field guns. That these could not be located by the navy seaplanes, as they were too heavy to rise out of range to observe. That the Germans were in charge and working things efficiently, that there were good searchlights with well trained observers, and that the flat trajectory guns of the Navy did not bother them.

Following the disastrous bombardment of March 18, both Commanders-in-Chief sent dispatches on March 23, to their Home superior, indicating that they were in agreement that the purely naval attack would have to be abandoned, and that the next attack required careful preparation. Hamilton made the following points:

(a) The whole military force must co-operate.

(b) March is a bad weather month. April would be better.

(c) Careful planning and allocation required, which takes time.

(d) Important to organize thoroughly the expedition at a convenient base like Alexandria.

De Robeck mentioned the following:

(a) Army would not be ready till April 14.

(b) All the Strait's guns must be destroyed, but ship gunfire can only put out a few.

(c) Great opposition to be expected.

(d) Mine menace great.

(e) Recommended well prepared attempt next month.

(f) Howitzers hard to spot from the sea.

(g) Land forces must occupy Gallipoli Peninsula before big ships can go through.

The following extracts from De Robeck's report of March 27, to the First Lord on the effect of naval gunfire on forts is worthy of note:

> The assumption underlying the plan originally approved for forcing the Dardanelles, by ships, was that forts could be destroyed by gunfire alone. As applied to the attacking of open forts, by high velocity fire, this assumption has been conclusively disproved.
>
> It has been impracticable, even at ranges of 700 or 800 yards, to obtain direct hits on each gun. . . . In Fort 4 . . . . although . . . . heavily shelled for two days, at both long and short range, one gun was found loaded and ready to fire.
>
> At the most it is possible for ships to dominate the forts to such an extent that the guns cannot be fought by their crews.

Therefore, on March 23, the purely naval attack was abandoned, and operations were postponed.

Joint Operations Begin

Finally, after such preparation as was possible, the *attack of April 25* was made. This date is important, and marks the beginning of real joint operations, in which unfortunately for the attackers, the Navy was not able to accomplish with gunfire all that could be wished. Landings were made at several beaches near Cape Hellas, with Achi Baba as the immediate objective, and at Anzac Cove, with Sari Bair as the immediate objective of that force. After taking the immediate objectives, both forces were to work toward and take Kilid Bahr, commanding the Narrows.

The landings were made under great difficulties, through obstacles, in the face of a heavy fire, and the casualties were heavy. The advance made after landing fell far short of that planned.

The British found themselves entrenched near the beach, with their positions commanded by the enemy from superior positions. De Robeck acknowledged the Navy's inability to assist adequately as follows:

> The navy has not been able to give the army as great assistance as was anticipated. The Navy is of small assistance when it is a matter of trenches and field guns, and the check of the army is due to those factors. (May 9, 1915, De Robeck to Admiralty.)

Due to this check, the medical service was not able to establish the shore hospitals that had been planned, and the wounded had to be sent off to the hospital ships and transports used for wounded under difficult conditions, under fire, without sorting the casualties, as they should have been. This resulted in serious cases going sometimes to other than hospital ships, and slighter casualties going to the hospital ships, with resultant suffering due to lack of facilities. Even for lighter cases the Black ships, as the medical transports were called, were inadequately staffed and supplied. This was accounted for by the fact that no general plan of operations was worked out in the first place, permitting adequate arrangements to be started from the first, as such arrangements obviously take time. One is strongly reminded of the old saying attributed to the British themselves: "England will muddle through."

It is hardly necessary to follow through in detail the narrative of these unfortunate operations to draw the conclusions so plainly indicated.

About August 7, another distinct landing was made at Suvla, but ultimate results were disappointing. It cannot be ignored that here especially there was failure due at least partly to incompetence and lack of energy on the part of some general officers, but that is by no means the fundamental trouble with the operation.

Here there was trouble with the water supply, and men suffered for the lack of it, and precious time was lost from the advance that should have been made. It was a case of bad staff work. A painful hiatus was apparent where the water was delivered on the beach, due to lack of facilities for its distribution. Pack mules and water bags that had been counted upon for this purpose were not there, and receptacles were lacking. The worst feature

was that there did not seem to be a hooking up between those responsible for delivering the water to the beach, and those responsible for receiving and delivering it. There was inaction, and waiting for "somebody else to do it."

On October 15, 1915, General Hamilton was relieved of his command preliminary to the evacuation of the Gallipoli Peninsula. To the great surprise of all, the evacuation was carried out with inappreciable losses of life or material.

In the operations involved there had been employed about four hundred thousand British officers and soldiers. There were one hundred and twenty thousand casualties, including thirty-one thousand killed.

Discussion

It is a curious thing that although practically all men that had anything to do with the inception of this campaign recognized that a joint operation, that is, an amphibious one, was the proper one to undertake, nevertheless they proceeded with a purely naval one.

It is also a tragic example of a military operation being forced upon the professional sailors by a non-professional, and to state it mildly, over-enthusiastic chief, who in his technical ignorance, did not appreciate the functions or the limitations of the ships of the Navy.

The lack of preliminary planning and staff work would be unbelievable were it not attested by the Report of the Dardanelles Commission. Not only were the difficulties not appreciated but the preparations were inadequte. Before starting at all, the difficulties should have been faced, the other very great future demands upon men and munitions surveyed, and then, with data before them, the Staffs and War Council should have decided whether there was reasonable probability that the demands could be met for operations already underway and for the contemplated activity. As events proved, they could not be, and it could reasonably have been foreseen.

Conclusions

Once more military truths were accentuated, and in the most striking and tragic fashion, by the cruel reverses which followed the violation of fundamental principles.

(a) An overseas attack should be a surprise one. Nevertheless, in November, 1914, the Turks were warned by a preliminary and useless bombardment. And later, ships of the Navy were operating off the Dardanelles long before the necessary troops were ready.

(b) Naval guns cannot reduce shore fortifications. The old truth, long recognized, is still true. And the modern trenches and sunken gun emplacements are much harder to score a hit on than were the old fashioned forts or earth-works, that at least projected up from the ground and afforded a target.

(c) An overseas attack on defended positions should be a joint one, that is, the Navy and Army must co-operate, and supplement each other.

(d) If successful, the Dardanelles operation would have been worth a considerable cost of life and treasure.

(e) It should not have been started unless they were prepared to supply all the men and munitions required.

(f) It would possibly be presumptious to say that under certain conditions the operation would have been successful. However, the greatest probability of success would have attended the operation if they had recognized the difficulties, prepared for them, taking adequate time, and then, when both Army and Navy were ready, and not until then, had appeared for the first time off the Dardanelles as a surprise attack, made a joint attack without delay, and pushed it with energy.

(g) Information, plans, preparation, adequate force, surprise, joint action, prompt attack, and energetic follow up of advantages gained, might they not have culminated in success?

At least they would have afforded the best chance, and in war we do not deal in certainties.

(h) It is impossible to conclude a consideration of this campaign without paying tribute to the gallantry and determination of the troops involved, who faced tremendous difficulties and dangers with an indomitable will and superlative courage.

A MODERN FIELD HOSPITAL

By Colonel Dion Williams, U. S. Marine Corps

THE effectiveness of any military force may be measured as to questions of personnel by the percentage of the total personnel that is available for use on the front lines in the theater of operations; the higher this percentage can be maintained the greater will be the effective striking energy of the force assigned to carry out any specific military mission. To maintain any given fighting force in the theater of operations it is necessary to have a corresponding force of men back of the lines in the service of supply and in the training stations and camps where they will be constantly available to furnish the replacements to make good the unavoidable drainage from the front forces due to a variety of causes.

Experience teaches us that the greatest contribution to this constant drainage of manpower from the effective front line strength is made up of the sick and wounded who require hospitalization and that the conservation of manpower resulting from efficient hospitalization far exceeds the conservation resulting from all other means employed. The sick or wounded man not only reduces the effective strength during the time that he is on the sick list but the effective strength is also reduced by the number of men required to evacuate the sick and wounded from the front lines to the hospitals and to care for them while they are undergoing treatment in the hospitals. Hence, everything that can be done to increase the efficiency of the evacuation of the sick and wounded and to reduce the total number of sick days by increasing the efficiency of the hospital service results in a direct proportionate gain in the military effectiveness of any force.

At all of the permanent naval stations in the United States and the outlying possessions permanent naval hospitals are provided having every facility and convenience for the proper treatment of the sick and wounded, and where the sick and wounded can be quickly evacuated to these hospitals from their regular posts of

[Copyright: U. S. Naval Institute, Annapolis, Md.]

duty the solution of the problem is easy. However, when circumstances require that naval forces operate at a distance from the permanent bases and stations the problem becomes more difficult. Especially is this true of the expeditionary forces of the Marine Corps operating in foreign countries for the suppression of minor revolutions and disorders, the maintenance of treaty obligations, or the support of established state policies.

As a rule the theaters of operation for such expeditions are in countries where the development of sanitation and modern hospital facilities are particularly backward, and in many cases the climatic conditions are such as to cause an increase in the normal sick rate as experienced at the home stations of the troops.

The Navy, and the Marine Corps as the main landing force reliance of the Navy, have ever been proud of their constant state of readiness for any service they may be called upon to perform and of their mobility in carrying out the missions assigned to them in peace and war. Having in view the maintenance of the highest efficiency in readiness for any required service, the greatest mobility attainable, and the most efficient conservation of the trained manpower of the naval services, a system of hospitalization should be provided for the naval landing forces which will meet the probable requirements.

Considering the requirements of the Marine Corps expeditionary forces there are several possible methods for meeting the hospital needs and a consideration of these methods will show which one will best meet the requirements under varying conditions of service and mission. To accomplish this the methods employed in the past will be enumerated and discussed.

First; reliance may be placed upon hospital ships anchored at the base ports, to which the sick and wounded may be evacuated from the posts occupied by the landing forces. Hospital ships are primarily designed to transport sick and wounded from the theater of operations by sea routes to the permanent hospitals at the home stations or bases, and to anchor them in the base harbors of an expeditionary force and use them as stationary hospitals diverts them from their proper mission and from an economic standpoint results in a disproportionate overhead expense.

Second; existing hospital facilities in the country to be occupied may be taken over and operated as military hospitals. As a rule

the existing hospitals in localities where landing forces are called upon to operate are inadequate for the requirements of the civil population which they are designed to serve, and to place upon them the additional burden of caring for the personnel of an invading force would divert these institutions from their normal function, would deprive the civil population of the facilities which have been provided for their use, and would cause a natural feeling of resentment throughout the communities so imposed upon just at a time when every effort should be made to secure all possible co-operation between the members of the force of occupation and the local inhabitants.

In addition, the hospitals in the countries usually occupied by our landing forces are as a rule poorly constructed, insufficiently equipped, and are lacking in proper sanitary arrangements to make them fit places for the proper treatment of military personnel whose stay in the hospital should be made as short as possible by the provision of every possible means of efficient medical treatment and service.

Third; buildings may be commandeered or rented and fitted up as extemporized military hospitals. For this purpose very few suitable buildings are available, rentals would be high, the cost and time elements in refitting them for hospital use would be excessive and would violate the general rule that it is not advisable to expend large sums in repairs to rented buildings for government use. In practice it has been demonstrated that such buildings even with a considerable expenditure of money and time make indifferent hospitals, and that the same energy and money expended in other ways would secure far better results.

Fourth; field hospitals sheltered under tentage may be provided for the use of expeditionary forces. Experience has demonstrated that the use of tentage for quartering the members of military forces, except in cases where frequent changes of site are necessary, and the stay in any one locality is necessarily short, is a very expensive means as compared with temporary or even permanent buildings. For use as hospitals tents must be provided with good flooring and with screens to exclude flies and other insects, they form unsatisfactory protection in rainy climates, and are difficult to heat in cold climates. Nevertheless, in cases where frequent moves are required by the nature of the military opera-

tions the use of tentage for hospitals appears to be the solution indicated.

Fifth; portable buildings especially designed for the purpose may be provided with all of the necessary equipment and held in readiness for use with expeditionary forces in cases where the occupation promises to be of such nature as to demand hospitalization of a comparatively lengthy tenure at a port of debarkation and supply or at the central headquarters station of the forces of occupation.

From a consideration of the above enumerated methods it would appear that the best solution of the problem presented would be, in the case of temporary landings and occupations, to use tentage for housing the field hospitals, locating such field hospitals at the port or ports which offer the most convenient facilities for the evacuation of the more serious cases to hospital ships for subsequent transportation to the naval hospitals at home stations. During such temporary occupations of foreign territory, the sick and wounded at small outlying stations and outposts would also be housed in tents, those cases which would require protracted treatment being transported by ambulance or boat to the main field hospitals for further treatment or evacuation to home stations.

However, if the occupation of the foreign territory promises to be of long duration, as in the cases of Haiti and Santo Domingo, the use of tentage for field hospitals at base ports and headquarters stations and for sick bays at the small stations and outposts will not afford the requisite facilities for the proper treatment of the sick and wounded, and more nearly permanent facilities must be provided.

The present occupation of Santo Domingo by the naval forces began in November, 1916, and the first requirements from the military standpoint were the subjugation of numerous revolutionary bands, commonly styled "bandits," and the re-establishment of law and order in order that the policies of the United States government might be carried out in the fulfillment of treaty obligations and with due regard to the lasting peace of the country.

The fulfillment of this mission was entrusted to a brigade of marines and the subsequent operations required the occupation of certain selected ports as bases of operation and supply, the oc-

cupation of interior cities and towns throughout the country, and the dispatch of small columns and patrols by railroad, road and trail wherever it was found necessary in the course of operations designed to carry out the main mission of establishing law and order and aiding the loyal civil authorities in the conduct of local government and a general disarmament of the inhabitants.

During the early stages of the operations no intelligent estimate of the probable duration of the occupation could be made; it might require a few months or several years to accomplish the desired results; and the erection of even temporary buildings to house the various activities of the forces of occupation was apparently not justified.

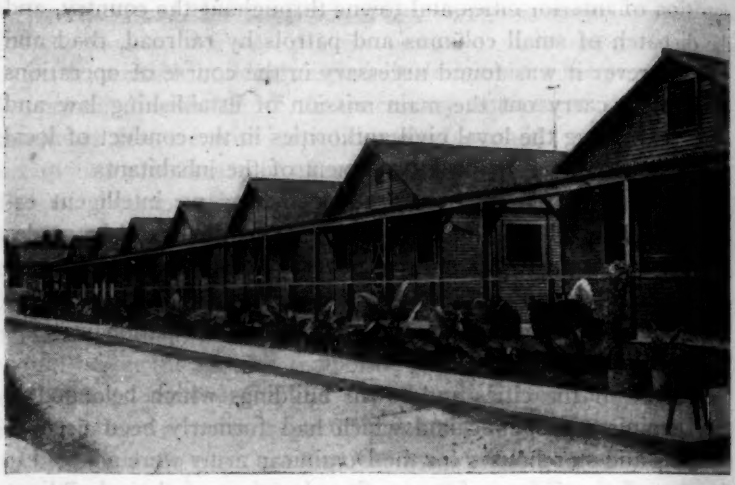
In some of the cities and towns buildings which belonged to the Dominican Republic and which had formerly been used as barracks and storehouses for the Dominican army were adapted to the uses of the forces of occupation, but few of these buildings were in any way suitable for use as hospitals or sick bays.

The Dominican cities and towns were lacking in hospital facilities to meet their own needs for the civilian population and it was not good policy to commandeer such facilities for military use at the expense of the civil population.

As a result, in some of the stations occupied buildings were leased and fitted up as temporary hospitals and at other stations tents were used for this purpose. In many cases very high rents were demanded and received for the buildings rented for military uses, and at best these buildings were but poorly suited to the needs of a hospital.

In the northern district of Santo Domingo, embracing about one-half the total area of the country, the headquarters was established at the principal city, Santiago de los Caballeros, a pleasant little city of 20,000 inhabitants located some forty miles inland from the well-known port of Puerto Plata at an elevation of about 1,000 feet above sea level. The climate of Santiago is of course tropical, but mild and salubrious and well suited as a site for a military hospital for the forces of occupation in the northern district.

In 1919 the military field hospital at Santiago was located in a rented building which had formerly been used as a bakery. This building was not suited for use as a hospital, but the expenditure



FIELD HOSPITAL, SANTIAGO, D. R.
Front View

SICK BAY, PUERTO PLATA, D. R.
Type of Outpost Sick Bay

of considerable money in addition to the high rent paid had made it as good for the purpose as was practicable.

At this time the appropriations for the naval service, including the Marine Corps, were very much reduced in the general campaign for retrenchment and economy following the heavy expenditures for the World War, and it became apparent that practically all of the rented buildings in Santo Domingo used by the marine forces of occupation would have to be given up and other arrangements made to house the activities thus displaced, in order to prevent creating over-expenditures of funds.

In the northern district one battalion and the headquarters of the fourth regiment of marines were stationed at Santiago, and the remainder of the regiment was disposed in one-company posts at the towns of Monte Cristi, Puerto Plata, Moca, La Vega, San Francisco de Macoris and Sanchez. At all of these stations some buildings were rented.

Supplies and replacements of personnel were received through the port of Puerto Plata, which was connected with the headquarters at Santiago by a narrow gauge railroad forty-four miles in length. This railroad extended twenty-two miles east of Santiago to the town of Moca, from whence a railroad of wider gauge connected with La Vega and the eastern seaport of Sanchez on Samana Bay, and by a branch line with the interior town of San Francisco de Macoris.

Santiago was connected with the western seaport of Monte Cristi by a wagon road seventy-two miles in length, and by an excellent macadam road with Moca, thirteen miles, and La Vega, twenty-six miles.

Having all of these facts in view, it was decided to erect a field hospital at the headquarters at Santiago, with small sick bays at the outposts of Monte Cristi, Puerto Plata, Moca, La Vega, San Francisco de Macoris, and Sanchez. These small sick bays were designed to care for the men at the outposts who might be temporarily sick or disabled, and, as the means of communication by railroad or motor ambulance over the wagon roads would serve the purpose efficiently, it was planned to transport all of the sick and wounded who might require lengthy treatment to the main field hospital at Santiago, from whence those who might require treatment that could not be given efficiently at the field hospital

could be easily evacuated by rail to Puerto Plata and thence by the monthly transport to Hampton Roads.

In the fall of 1919 requests had been made for the shipment of certain small portable buildings which had been manufactured for use as temporary naval field hospitals in France and Belgium and which were understood to be in storage in the United States. Requisitions were also made upon the Bureau of Medicine and Surgery for the medical and surgical equipment for an efficient field hospital designed to care for the sick and wounded of a force of 1,500 men.

These requests received favorable action at the Headquarters of the Marine Corps and the offices of the Navy Department having cognizance and in February, 1919, the medical and surgical equipment had been delivered at Santiago and six portable buildings had also been received. This number of buildings was just half enough to carry out the plan, but the additional buildings required were constructed of native lumber of poor quality, but the best that could be obtained locally. The cost of this lumber was much higher than the cost of good lumber in the United States and it would have been more economical, first cost alone considered, to have waited for shipments of lumber from the United States. But the rented buildings had to be vacated by the end of the fiscal year, June 30, 1920, and in order to have the new buildings ready in time it was decided to use the native lumber, the ultimate saving in rentals more than balancing the extra cost of the lumber.

A site was selected on a ridge on the outskirts of Santiago, having good drainage possibilities and admirably adapted for the purpose on account of this fact and the facts that it was far enough removed from the noises of the city and overlooked the valley of the Yaqui River down which prevailing breezes tended. This site was cleared and levelled and all surrounding streams and low places drained to reduce the mosquitoes. On the site there was an old field mess hall, the frame of which was adapted for use as a foundation for the building to house the mess hall and kitchen and afford a small room for use as recreation room for convalescent patients and the medical corpsmen attached to the hospital.

The plan of the hospital as finally completed shows the general design of the institution. In use it has been found that it fulfills

the requirements of such a field hospital for a tropical country, and that with the addition of a heating plant such a plan would fulfill the requirements for even a cold climate. The width of the portable buildings, twenty feet, has been found sufficient to accommodate comfortably two rows of beds for patients in the wards, but in future buildings designed for this purpose it would be more economical in manufacture and erection to make the buildings forty-eight feet long, the ones furnished for this hospital being but thirty-two feet long.

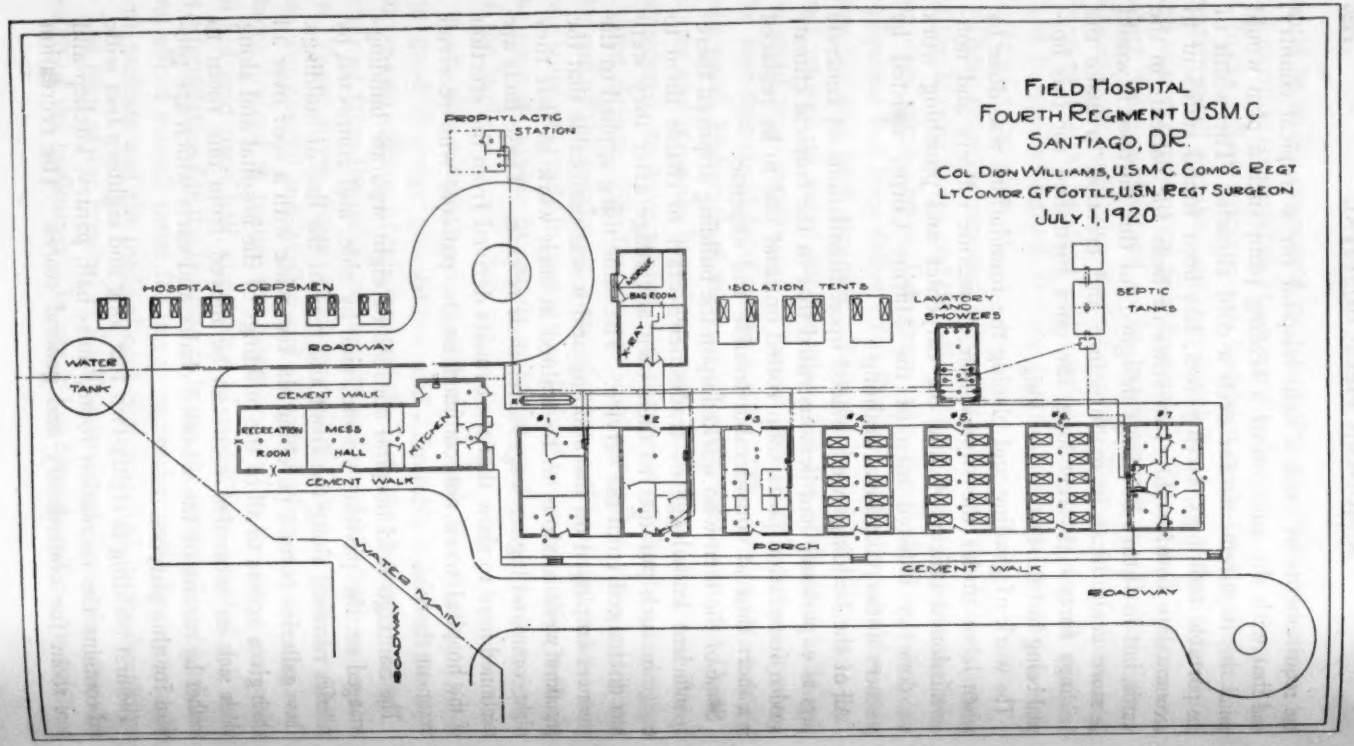
The work of grading and placing the foundations was done by prison labor under the supervision of marine officers and non-commissioned officers; while the carpenter and plumbing work was done by enlisted men of the Marine Corps, assisted by prisoners under vocational training.

All of the buildings were placed upon foundations of concrete piers as experience had demonstrated that in the tropical climate wooden foundation posts soon rotted out and had to be replaced in a short time at considerable trouble and expense.

Some of the men who worked upon the building acquired thereby sufficient knowledge of tradesmen's craft to enable them to engage in such pursuits to their own advantage after they were later discharged from the service. The same thing applied to the prisoners employed on the building and it was noticeable that the prisoners were anxious to be trained in such work so that they might command higher wages after their release. These facts are mentioned here to show that the benefits derived from the erection of the hospital were not confined to the patients who received treatment therein.

The Santiago field hospital consists of eight separate buildings arranged on the pavilion system, side by side, and connected by galleries running along the front and rear of the line of buildings. These galleries form a porching six feet wide with a roof over all which gives access to all of the buildings of the hospital and along which sick or wounded men can be moved from one room to another by means of the wheeled chairs and carts which are provided for this purpose.

The first building is eighty-two feet long and eighteen feet wide and contains the recreation room, mess hall, pantry, kitchen and store room for commissary and general stores. The recreation


FIELD HOSPITAL
FOURTH REGIMENT U.S.M.C.
SANTIAGO, D.R.
COL. DION WILLIAMS, U.S.M.C. COMDG. REGT
LT. COMDR. G.F. COTTLE, U.S.N. REGT. SURGEON
JULY 1, 1920
PROPHYLACTIC STATION
HOSPITAL CORPSMEN
ROADWAY
WATER TANK
CEMENT WALK
RECREATION ROOM
MESS HALL
KITCHEN
CEMENT WALK
BAG ROOM
ISOLATION TENTS
LAVATORY AND SHOWERS
SEPTIC TANKS
#1
#2
#3
#4
#5
#6
#7
PORCH
CEMENT WALK
ROADWAY
WATER MAIN
ROADWAY

room is eighteen feet square, and the mess hall eighteen feet wide and thirty feet long; the pantry six feet by eighteen feet; the kitchen is an L-shaped room with three hundred and eighty square feet of floor space, and the storeroom is eighteen by ten feet in size.

The next six buildings are each twenty feet wide and thirty-two feet long. The first one has two offices in front, each ten by twelve feet floor space, the dispensary in rear with a floor space eight by twelve feet, and the remainder of the building is occupied by the medical storeroom which has a floor space of three hundred square feet and shelving especially designed to hold the medical stores of the regiment.

The second building contains the laboratory, with a floor space sixteen by twenty feet, in the rear and two offices in front, each sixteen by ten feet in plan; one of these offices being the office of the medical officer-of-the-day and the examining room and the other being the workroom of the dental surgeon. The laboratory is fully equipped for research with a special view to disease prevalent in the tropics.

The third building of the row contains the operating rooms and accessories, the main operating room extending across the rear of the building with floor space twelve by twenty feet. In the front of the building is a dressing room eight by twelve feet, and a special treatment room eight feet square. A six-foot hallway runs from the dressing room a distance of twelve feet back to the operating room and on either side of this hallway there is a room eight by nine feet, one room being occupied by the sterilizers and the other being for use as an anesthetizing chamber. There are ample quarters in the dressing room, special treatment rooms, sterilizing room and anesthetizing room, where the surgical dressings and stores are kept.

The next three buildings en suite along the galleries are wards one two and three, each having a floor space of twenty by thirty-two feet, comfortably containing ten beds with bedside lockers and serving tables.

The last building in the row is the officer's ward which is thirty-two by twenty-two feet in plan, and contains four rooms with ten by twelve feet of floor space, arranged on either side of a central hallway seven feet and a half wide, at the end of which is a bathroom with floor seven and a half feet square. Each room has two

windows with glazed sashes opening on side hinges. Each room has a large closet for the occupant's clothing and effects and there are two large closets opening into the hallway in which are stored the bedding and linen for the officers' rooms.

In the rear of the center of the suite of buildings there is a building twelve by twenty-eight feet which contains the lavatory, closets and shower baths for the patients in the hospital.

For use of patient having contagious diseases there are three hospital tents with permanent wooden floors pitched on line in rear of the hospital.

In rear of the mess hall and galley there are six wall tents with permanent wooden floors and side frames for use as quarters of the hospital corpsmen attached to the field hospital.

The equipment and furnishing of the new hospital are in thorough keeping with the fine buildings. The three men's wards are furnished with white enameled beds, bedside lockers, serving tables and chairs and each ward has a white enameled table with linen cover presented by the Fourth Regiment Society, an organization composed of the wives and sisters of officers of the regiment and engaged in welfare work for the enlisted personnel of the regiment. On this table there is a neat pincushion and flower basket which is kept filled with flowers by the ladies of the society, and the books and magazines for the patients are also kept on the table. In each ward there is a white iron and glass medicine case.

The officers' ward is very completely furnished, each one of the four rooms having a white enameled bed, bureau, side chair and a large morris chair, and a table with a handsome drop light. All of the fine linen sheets and pillow cases, bureau and table covers, and the woolen blankets for this ward have been presented through the efforts of the Fourth Regiment Society. The Bureau of Medicine and Surgery has supplied a fine set of china and silver for the use of the officers sick in the hospital. In the hallway of the officers' ward there is a writing table with a complete writing set presented by the Fourth Regiment Society.

The laboratory and operating rooms are completely fitted out with every modern necessity and convenience, all provided especially for the new hospital by the Bureau of Medicine and Surgery, and the same bureau has furnished desks, office chairs and

filing cabinets for the offices of the regimental surgeon, the medical officer-of-the-day and the pharmacist.

The office of the dental surgeon is completely fitted up with every necessity and convenience for the highest class of modern dentistry.

The dispensary is fitted with handsome marked shelf bottles for the medicine in daily use and the medical storeroom adjoining it is fully stocked with all of the medical supplies that may be required in this hospital and also in the sick bays at the outposts in the northern district.

A modern plumbing system has been installed with running water all over the institution and a large septic tank to receive all the drainage. The lavatory is in a separate building in rear of the main building and connected with the rear gallery. It is fitted with porcelain hand basins and toilets and excellent shower baths.

The kitchen has every convenience, a large ice box, sinks with running water and sanitary drains, wheeled serving tables and a large storeroom for commissary supplies. Between the kitchen and mess hall is a pantry for storing the china, glassware and tableware; in the mess hall there are four tables with chairs to seat forty persons, corpsmen and patients.

The recreation room has a fine new pool table, large morris chairs, tables for magazines and papers and cases for books.

The buildings are lighted throughout by electric lights and current for these lights is supplied by the Santiago Light and Power Company with a Delco plant for emergency use.

Water is supplied from the Santiago city reservoir but a large iron tank has been erected for an emergency supply in case the reservoir should run dry as sometimes happens.

The hospital corpsmen are quartered in wall tents pitched in a line east of the hospital recreation room and mess hall.

An excellent macadam road has been built from the head of 27 de Febrero Street up past the supply company camp to the field hospital and along the front of the hospital. There is also a wide concrete sidewalk along the entire front of the hospital buildings and this walk is separated from the front gallery of the hospital buildings by a five-foot garden space in which a large number of ferns and plants are planted.

The location of the hospital is admirable for the purpose,

the institution being built upon a ridge running north and south which gives excellent drainage in every direction away from the buildings. There are no city streets or houses near the hospital, so that the noise of traffic and city life will not interfere with the rest of the sick. The view from the galleries over the city of Santiago and up and down the valley of the Yaqui River is a fine one and the prevailing easterly breeze coming down the valley has a full sweep through all of the buildings.

No trouble or expense has been spared in designing, building and fitting up the hospital and the result is an ideal institution for the care of the sick officers and men of the northern district, where they may have every care and attention that medical skill has devised and every comfort that can be thought of by those having the welfare of the fourth regiment at heart.

Electric current for the lighting of the hospital was originally supplied by the power company which furnished current for lighting the city of Santiago, but the financial difficulties of this company have resulted in shut-downs for long periods, and a large Delco lighting plant was installed to furnish light for the hospital and nearby buildings and camp of the quartermaster department.

As the local power company also furnished power for pumping water for the city system, there was no water in the city reservoir when the power plant was shut down. In order that the hospital might always have a sufficient water supply, its water system was connected with an emergency system installed by the force of occupation to pump water from the Yaqui River into the cisterns and reservoirs of the garrison.

The small sick bays erected at the outlying stations were small buildings containing an office for the surgeon, a small operating room, a dispensary, and a room large enough to hold six beds for sick under limited treatment.

The whole system answered the requirements of a regiment distributed to the principal towns of the northern portion of Santo Domingo, in that it provided immediate hospital facilities at each of the outlying stations, with excellent hospital and surgical facilities at the central field hospital for any treatment of a protracted nature.

Following out the policy of centralization of the forces of occu-

pation in a few of the principal cities of the Dominican Republic, in preparation for the establishment of complete control of the affairs of the country by its own officials and the ultimate withdrawal of the American forces, most of the outlying stations above mentioned have been discontinued, the fourth regiment of Marines being mostly concentrated in Santiago. Under these conditions the small sick bays at the outlying stations are no longer needed, but the field hospital at Santiago is ample to care for the normal sick of the regiment concentrated at Santiago.

This account of the system planned to meet the local conditions in Northern Santo Domingo for a Marine Corps force of occupation is published with the idea that it may be of assistance to the officers who may be confronted with like conditions in other countries where we may be called upon to operate. The buildings were erected by adapting the means at hand to the necessities as they appeared at the time, and it is thought that the best results practicable were obtained with the means at hand. However, if the whole subject should receive investigation and study, having in view the experiences of the past and the possible requirements of the future, much time and expense might be saved in future operations. Everything that can be done in the way of practical planning for the future in the provision of excellent hospital facilities for Naval landing forces will result in the reduction of the number of total sick days, thus giving more men for active duties and reducing the overhead expense in caring for sick men, who are, unfortunately, only a burden to any operating military force.

Putting aside the cold-blooded, practical questions of military efficiency produced by reducing the total number of sick days in any military force, humanitarian considerations should dictate a policy which would give the quickest and most efficient relief to sick and wounded men, and this can best be accomplished by providing the best possible and practicable facilities for hospitalization and evacuation of sick and wounded officers and men.

It is suggested that the subject be given careful consideration by both line and medical officers, in order that provision may be made beforehand to meet the requirements likely to arise. In this as in all other questions of preparedness, "an ounce of prevention is worth a pound of cure."

DISCUSSION

The Proposed Amalgamation Bill

(See page 919, June, 1923, PROCEEDINGS)

REAR ADMIRAL N. C. TWINNING, U. S. NAVY, RETIRED.—As a basis for an intelligent discussion of the proposed plan of amalgamation we should first have a clear understanding of the object of the plan; that is, what are the existing evils which are to be corrected and how is the plan intended to correct them? Secondly, we should consider whether or not the measures proposed would probably have the expected effect and, if so, whether the ends sought would be realized without bringing about other conditions as objectionable as those now existing.

The proposed bill has been framed in the Navy Department and it must be assumed that the Secretary of the Navy and his advisers believe that some such change from existing organization is necessary or desirable in order to increase the efficiency either of the several corps involved or of the navy as a whole. As Commander Fisher puts it, "It is natural to suppose that direct and tangible benefits to the Navy and to the nation should result from the bill, otherwise there would be no purpose in enacting it into law."

But what are the conditions which the plan seeks to alter? What are the existing evils for the elimination of which so marked a change in the organization of the Navy is thought to be desirable? To quote again from Commander Fisher's paper, "The proponents of the bill have failed to state what benefit is to accrue to the Navy if the bill becomes a law." The present writer has neither seen in print nor heard of any authoritative statement by the Secretary of the Navy on this head other than the very general one that harmony in the naval establishment would be contributed to by placing all the officers of the Navy on a single list. In the absence of any more comprehensive statement from a responsible source it is necessary to deduce the reasons from our own knowledge of existing conditions in the Navy or to infer them from the terms of the proposed bill which embodies the corrective measures.

From Commander Fisher's paper, which indicates that he has given careful and logical thought to the subject, the following statements are culled:

1. "A 'pro-amalgamationist' when pinned down will usually say that it (amalgamation) will do away with 'cliques,' stop the old 'line and staff' arguments, eliminate friction, and increase flexibility in assigning officers to duty."

2. "Few, if any, officers would object to removing the staff distinguishing marks from the uniform."

3. "Practically no objection would be made to abolishing the staff titles for the various staff grades."

4. ". . . . there would be no objection to combining all officers on one lineal list. . . ."

5. "Unequal probabilities of promotion even now exist between officers of equal length of service but in different branches of the Navy."

6. ". . . . there is no doubt that a certain amount of sea service for all officers would be highly beneficial for many reasons."

7. "With all due respect to the line's jealously guarded prerogative of exercising 'military command,' especially command at sea, the fact remains that unless every officer be given authority commensurate with his responsibility a tremendous handicap is at once imposed upon him and the success of his work is imperiled."

Without making Commander Fisher in any way responsible for statements not his own the foregoing seven quotations seem to yield the following as the definite evil conditions supposed to exist and for which amalgamation is proposed as the cure:

a. Existence of "cliques" in the navy.
b. Prevalence of "line and staff" arguments.
c. Friction due to existence of different corps.
d. Staff distinguishing marks on uniforms.
e. Staff officers having grade titles and having "the rank of" certain line grades.
f. Separate lineal lists of line and staff officers.
g. Unequal probabilities of promotion as among the several corps.
h. Lack of flexibility in assignment of officers to duty.
i. Insufficient authority granted to officers of staff corps.
j. Insufficiency of sea service for officers of some corps.

Turning now to a consideration of the principal provisions of the bill we note that:

1. All officers of the three staff corps concerned are transferred to the line and are to be commissioned in the line in the grades they hold at the time of transfer. This transfer does away, at a stroke, and to a greater or less degree, with the evils listed as *a*, *b*, *c*, *d*, *e*, and *f*.

2. Past inequalities of promotion to certain grades are to be rectified on next promotion and officers of former staff corps are to enjoy equal privileges as to eligibility for promotion with other line officers. These provisions are calculated to meet, to a great extent, the evil listed above as *g*, unequal probabilities of promotion.

3. Officers of former staff corps are either required or permitted (depending on age) to qualify for line duties; if so qualified they become eligible for all line duties at sea and on shore including, of course, command; if not so qualified they are to continue to perform former

duties and are to have all necessary authority; officers of present line below grade of lieutenant-commander are to be available for assignment to duties formerly performed by officers of the staff corps; line officers are not required to qualify for staff corps duties; qualifications of officers for performing duties of the old line and former staff corps are to be made a matter of record.

These provisions are obviously intended to correct the evils listed above as *h* and *i*, the extent to which they will accomplish the cure of *h*, lack of flexibility, is questionable.

4. With certain obviously necessary exceptions sea service is to be a requirement for promotion for all line officers. This provision aims to correct condition *j*.

Aside from certain provisions as to the date when some portions of the Act or requirements of existing law are to become effective the above brief synopsis contains all the provisions of the proposed bill which are germane to the matter of amalgamation. Without regard, for the moment, to the effectiveness of the several provisions it is evident that they are intended to meet the unsatisfactory conditions previously set forth under heading 1-7 and re-stated as *a* to *j*.

The only ones of the sought-for objects which can be said to be accomplished with certainty are those of doing away with distinctions of title and uniform and with separate lists of officers; as these results would naturally flow from any amalgamation of the several corps the merits of the plan must be judged by its probable effects in other respects. Regardless of the provisions of the particular plan proposed in the matter of rank, promotion, and such details, is the amalgamation desirable and will it make for increased efficiency of the Navy?

While "the Navy" comprises material and personnel, ships, bases, and administrative establishments, its essential portion is the fleet, the fighting ships with their combatant personnel. All its other components, while having their importance and (most of them) being necessary for the support of the fleet, are auxiliaries. Do away with the fleet and the auxiliaries have no reason for being; do away with the auxiliaries and the *reason* for the fleet's existence still remains. There are, therefore, two distinct elements in the naval personnel, the fighting or combatant element (traditionally known as "the line") and the auxiliary or non-combatant element which we call the staff. No amount of argument, no change of uniforms nor of titles, can alter the fundamental fact that the functions and duties of naval personnel are naturally and inevitably differentiated in this way.

To say that duties and functions naturally divide themselves into the categories of combatant (line) and auxiliary (staff) is not necessarily to say that duties of the two classes cannot be performed by one class of officers; they can be provided their combined scope is not too great for the officers of any one class to master and become proficient in. The writer does not believe that any one officer, be he of line or of staff, can become proficient in all the duties now devolving upon officers of the

line, the Construction Corps, the Supply Corps, and the Corps of Civil Engineers; so to believe would be to underestimate and belittle the professional requirements of each of these corps. In this opinion, it is believed that every officer of the Navy, without distinction of corps and without individual exception, will concur if he puts the question baldly to himself, "Can I possibly become an efficient line officer, naval constructor, supply officer, and civil engineer?"

If the foregoing conclusion be accepted, as the writer believes it must be, it necessarily follows that, in an amalgamated line, some officers must specialize in line duties, some in supply duties, and so on, since all these duties remain to be done just as at present. Let us see to what extent the proposed plan provides for the continued efficient execution of the functions of the several staff corps involved.

An examination of the *Navy Register* of January 1, 1923, shows that, under the provisions of Section 6 of the bill approximately twenty per cent of the officers of the Supply Corps, twenty-eight per cent of the Constructors, and forty-five per cent of the Civil Engineers must, within four years, be given full opportunity to qualify for line duties. Furthermore, some officers in the several corps who are over thirty-one years of age will doubtless avail themselves of the provisions of Section 5 and be assigned temporarily to general line duties.

As none of the staff corps now has more than enough officers qualified for the general duties of the corps it is difficult to see how those duties are to be carried on during the period of from one to four years during which so large a percentage of the officers is diverted to other duties. This condition, however unfortunate, might be accepted as a temporary one to be met "somehow" but if we look farther ahead the condition appears to grow worse rather than better. As Commander Fisher points out, "After those officers above thirty-one years of age, who are now in the staff corps and who do not qualify for line duties, have disappeared from the Navy List, there will remain none who are expert in the specialties necessary for the proper administration of the Navy's business. Absolutely no provision whatever is made for recruiting and training specialists in pay matters, naval construction, and civil engineering, nor is there any assurance that future officers who may desire to specialize along these lines will be permitted to devote the principal part of their time to such specialties."

Unless all line officers are to become jacks-of-all-trades (with the proverbial consequence) there must be specialization. Commander Fisher's suggested plan for amalgamation with provision for specialization has a number of excellent features and, if amalgamation were inevitable, the writer believes that this plan should be adopted, at least in its essential features; but in the development of the plan the essential difference between line and auxiliary duties has been overlooked. The principle of "proportional promotion" is relied on to insure the maintenance of the proper number of specialists in each grade and to guarantee equal chances

of promotion to specialists and to general duty officers. This reliance is probably justified granting that enough officers elect to specialize.

A serious objection to this plan is found when we approach the tender subject of command, that "jealously guarded prerogative" of the line. Military command is the natural prerogative of the combatant branch of any military service—not a *privilege* to be maintained against just claims of other branches—a right, a prerogative inherent in the principles of military organization. Moreover, it is a prerogative for the exercise of which training is necessary. If a specialist in auxiliary duties is to be employed for "at least two-thirds of his time in each grade" in the pursuit of his specialty he has only one-third of his time to pursue the major specialty of a military service, the training for and exercise of command. Certainly a "plain" line officer who should devote only one-third of his time to the pursuit of the civil engineering profession could not have any just claim to the highest positions open to civil engineering specialists; rules should work both ways. And what of the specialist's profession? Can a naval constructor attain the highest proficiency in his profession if, for two years out of each six, he lays it aside to become a "plain" line officer?

With much that Commander Fisher says of the excellent features of the suggested plan it is a pleasure heartily to agree but the writer cannot agree that, to an officer who devotes two-thirds of his time to non-combatant specialties, the highest posts of command should be open. Perhaps Commander Fisher does not mean that they should, but his words, ". . . . in the amalgamation must be included all of the privileges and rights of all parties to it, or else all parties must sacrifice the same rights," seem subject to that interpretation.

There can be no question that every officer, no matter what his corps or other status, should have "authority commensurate with his responsibility"; the writer believes that existing law amply assures to officers of staff corps such authority and that no legislation should be sought which would, directly or indirectly, confer on other than line officers the right to military command. He further believes that if an officer elects to specialize in an auxiliary professional branch he should thereby sacrifice his right to the exercise of the military prerogative of command.

The amalgamation of the old Engineer Corps with the line, which was effected in 1899, had as one of its major avowed objects, if not the principal one, the removal of friction; there undoubtedly was an amount of friction which seriously affected the efficiency of the navy and this was removed by making the engineer officers line officers; that was not the whole story of the amalgamation, however; the older officers of the old Engineer Corps were restricted to the performance of engineering duty only on shore only; a corps of warrant engineers was established; and (subsequently) two or three plans were adopted for providing so-called "designing engineers." In short, the Engineer *Corps* was merged

in the line but provision for carrying on some of its duties by specializing engineers was made.

In its inception the Engineer Corps was little more than a body of practical steam engineers who were skilled in a profession that was distinctly auxiliary to the naval profession. The rapid extension of their professional field and the application of steam and electricity to so many uses on board ship brought the engineering profession, at least the operative side of it, into such close relationship with the combatant service that the two were practically merged; the engineer became as much a combatant as the line officer and the latter necessarily became an engineer. The amalgamation was natural, necessary, and inevitable aside from any reasons found in line and staff friction.

It is believed that the results of the amalgamation have been, on the whole, beneficial, but the time has not yet come to determine definitely whether the field of design and construction will be as well taken care of under the present system as under the old. As to the operating duties, the engineer-in-chief has recently stated in a paper published in these PROCEEDINGS that "the efficiency of the navy is now suffering from a fallacious idea on the part of some younger officers that engineering duty can be neglected without interfering with their development for high command."

Whatever just criticisms may be made of the provisions of the bill as to distribution of officers, determination of precedence, assurance of equality of promotion, and other such incidental matters, it may be assumed that the criticisms can be met, in great measure if not completely, by changes and that a fairly satisfactory result can be arrived at but the plan of amalgamation or consolidation can only result, as Commander Fisher justly says, in the extinction, not only of the staff corps, but of any body of officers trained to carry on their duties.

Supposing an "amalgamated line" to have been created by combining the present line and the three staff corps involved in the proposed plan; all the duties now performed by officers of the four branches will still have to be carried on either by specializing officers or by officers who are theoretically supposed to be qualified for any and all the duties. If the former plan be followed we shall have the old staff corps still existing in the line and nothing will have been gained in the matter of flexibility of detail to duty; nothing will have been changed except that the staff officers will be called line officers and will be promoted as such if a workable plan of proportional promotion be made a feature of the plan. If the latter plan be followed flexibility and the elimination of friction will have been bought at a heavy cost to the efficiency to the Navy.

Not the least interesting portion of Commander Fisher's paper is that appearing under the caption, "Will Amalgamation Solve the Problem?" Existing conditions as to Bureau "cognizance," lack of parallelism between Navy Department and navy yard organization, system of appropriations, complicated accounting, and others mentioned are, in the writer's opinion,

responsible to a far greater extent for inefficiency waste, lost motion, and friction than is the existence of separate staff corps; the amalgamation, elimination, or extinction of the latter, while it might accomplish something toward correcting some minor existing evils, would, on the whole, make matters worse by reducing the efficiency of both line and staff and by setting up new difficulties of administration.

The Proposed Amalgamation Bill

(See page 919, June, 1923, PROCEEDINGS)

CAPTAIN ELLIOT SNOW (CC), U. S. NAVY.—If a complete and thorough analysis of the advantages of a Navy "with Corps" and a Navy "without Corps" be made by an impartial, representative body of naval officers of long experience shows, without reasonable doubt, that the *probable* (not possible) advantages of "no Corps" greatly outweigh the *known* advantages of a Navy "with Corps" then, and only then, has the time arrived when the change should be made. In short, if the controlling opinion of the service adjudges that a sweeping and all inclusive amalgamation is *necessary* for its best interests, then a suitable bill to this effect should be drawn up. The bill, however, should be briefer and simpler than the one proposed and be one that does not attempt to conserve the *interests of individuals,* in regard to *rank, pay* or *duty.*

It is now quite possible for the responsible executives of the Navy Department to arrive at a knowledge of such controlling opinion, because the Navy Department has recently asked and received the views of many officers on the subject of amalgamation. These views are from no less authorities than the Chief of Naval Operations, the Chiefs of Bureaus, the General Board, the Major General Commandant of the Marine Corps and the Judge Advocate General of the Navy (Navy Dept. file No. Op-10 26509-493, March 7, 1923). The opinions of these officers are, at present, the controlling ones. Some. and perhaps all of them sought, were furnished with, and weighed the advice of many others before recording their views, and in all probability they did not hold to their own views in the face of sound contrary advice and counsel thus acquired. If rumor is to be credited, some experienced officers, unbidden by the Department, have also registered their views *against* the proposed amalgamation.

A law that will permit of logical duty assignments, commensurate with experience and demonstrated ability, and under which authority is coupled with responsibility, would, if wisely executed, go further toward promoting efficiency in the service than any other one single step that could be taken. Such a law is briefly and clearly stated by the author in the section of the article devoted to "kind of duty to be performed; its corresponding authority and responsibility."

The service today suffers much from the entertainment of the opinion —a foolish one though it be—by a number of officers that their brothers-

in-arm in the Staff Corps are not a part of the Navy. They *are* a part of the Navy, and a very necessary part of it, too. Why should Corps not exist under an organization in which all officers are eligible for any duty, at sea or on shore, commensurate with their experience, ability, and demonstrated capacity, and while so assigned have full authority and command over all officers and enlisted men serving under them? Private business organizations claim and exercise the right to utilize to the best advantage the services of their entire corps of specialists and experts—why should the Navy not do likewise?

The Proposed Amalgamation Bill

(See page 919, June, 1923, PROCEEDINGS)

LIEUT.-COMMANDER K. C. MCINTOSH (SC), U. S. NAVY.—In discussing the proposed Amalgamation Bill, Commander Fisher has stated that he is trying to be neither for nor against, that he is endeavoring to give an impartial review of the question. In order to do this he has adopted the only viewpoint from which such an attitude is possible: i. e., that the intention of the bill as expressed in the accompanying memorandum would be the real effect of the bill as written. Recent experience in these days of mammoth checkages for aviation pay, dependent allowances, uniform gratuities, etc., should lead us all rather to look at the wording of the bill itself. When a law is proposed which affects the career, pay and promotion of all of us, the only safe course is to read the bill itself in the light of what it *can* do, of what its wording will actually accomplish rather than in that of the intentions and assumptions of the fair-minded most of us.

Looked at from this angle, the impartial viewpoint becomes rather difficult to maintain. Some of the subsequent remarks may be brutally frank; so I hasten to say at the outset that they are confined to the bald wording of the bill itself, and impute no malign intentions to the framers. I know them too well and know them to be incapable of anything but the fairest intentions.

The memorandum holds as a model, the amalgamation of 1899. We are apt to forget that the amalgamation of 1899 *did not work*. The engineer officers of today are not functioning under the amalgamation of 1899, but under subsequent legislation which made their specializing in engineering—so vitally necessary to the Navy—possible as well as attractive. The amalgamation of 1899 provided two safeguards for former engineer officers of or above the rank of lieutenant commander which are lacking in the present bill: i. e., the extra-number promotion provision, and the guarantee of specialty of duty only. As we all know, the extra-number provision was repealed, and the engineering duty—only provision nullified by Departmental action. Engineers who had chosen not to qualify for straight line duty were ultimately ordered to perform it just

the same. Not until the present system was established which creates an engineer corps composed of line officers prohibited from exercising the central line function—Command—did "amalgamation" of engineers really begin to pay dividends. The *men* are amalgamated. The *duties* will not amalgamate, although they are much closer to the military side of the Navy than most of industrial functions which this proposed bill covers.

Reference to amalgamation of the Construction Corps and Civil Engineer Corps will not be undertaken—I do not know enough about either profession. The Supply Corps, however, embraces what are considered six major and distinct professions in civil life: purchasing, warehousing, accounting, rail transportation and ocean transportation. In order to carry out these duties, the officers of the Supply Corps have had to specialize to some degree: These six professions are, however, all purely commercial, and the fundamental principles of economics govern all. It is not difficult to shift from one of them to another, if the officer shifted has had time to acquaint himself with the terrain and special features of the new billet. The above remark does not apply, however, to a shift from a commercial duty to a military duty or vice versa. An entirely different set of laws and principles governs. Granting the ability of any one man to become and remain proficient in all line professions and all Supply Corps professions, it is inevitable that his usefulness in one set of duties or the other will be weakened, probably in both. For example, the gunnery officer is concerned only, and rightly, with shells that will function efficiently. When it is necessary to use them, he wants to use plenty of them. Any given shell will explode with unchanged efficiency whether it cost the government fifty dollars or five thousand dollars. The gunnery officer should not care—expense is not a matter of gunnery, for he is concerned only with quality. The purchasing officer, however, must never be imbued with this "shells at any cost" philosophy. His mission is to see that the gunnery officer is supplied with shells of suitable quality (to be determined by the gunnery officer), and suitable number (also to be determined by the gunnery officer), but at the fifty dollar price instead of the five hundred dollar price. Concerning this last, the gunnery officer should not be obliged even to think. There are times when a training in true economy would handicap the initiative of commanding officers. There are many more times when a competent line training would double costs to the Navy in purchasing, and has done so in the past.

After the experienced officers trained to Supply Corps duties have been eliminated by time and the operation of the attached bill, the six major professions of the Corps are to be carried on by detail of Naval Academy graduates, as incidental to their general line duties. There is no connection between naval line training and business; and while successful business men are all trained economists, they none of them regard any of the six professions as a matter for temporary detail, nor as an incident to any other profession. The Supply Corps has given the Navy an excellent business reputation; but it has done so not only by making

their profession a main line but by working overtime at it. We have developed four of our six professions to a point well beyond the civilian average, if business experts may be believed, but we have done it by uninterrupted effort and single interest therein.

Having discussed at the start the difficulties, to my mind insuperable, of amalgamation as a principle, the features of the present bill are commented upon as follows:

The conditions given under "Second" in the Memorandum are unchallengeable with the exception of (f) if amalgamation in any form is to be put through. The dubious policy of (f) is recognized by the interpellation of (probably) in the memorandum. In considering the bill itself, however, the text is seen to depart widely from the stated objects in view. It will be shown that the bill as submitted for comment will

(a) Definitely increase costs in some amount and indirectly multiply them considerably.

(b) Make promotion of many officers, now indefinite in date but ultimately certain, a very problematical matter. In some cases it will assure no promotion.

(c) Nothing in this bill prevents promotion "out of all proportion" if it shall seem advisable to a future selection board to make such promotion. The wording of the proposed law would not operate to do away with such promotions as the one noted for rear admiral is not the "next higher grade" above lieutenant commander. This sea-service requirement does place a sure weapon in the hands of whoever desires it to make impossible the promotion of any officer, however.

(d) Existing law can take care of this feature.

(e) The proposed bill does not insure anything. It mentions "preference" but makes nothing mandatory. It leaves discretion in the hands of unspecified persons to determine relative fitness, against which preference has little or no weight.

The Bill Itself

SECTION II. Taking the January, 1922, *Register* as a basis, the new percentages provide vacancies for the immediate promotion of forty-six commanders to the rank of captain. Under the provisions of Section VIII, only *one* pay inspector was eligible to promotion on that date, although nearly two-thirds of the vacancies thus created are due to the assimilation of the Supply Corps.

There would be immediately created some six vacancies in the grade of commander. The memorandum notes that some staff officers have already been held back from promotion commensurate with their length of service. Forty-four such officers are Supply Corps lieutenant commanders. Of this number, thirty-three are ineligible under Section VIII, although they admittedly have already lost promotion through no fault of their own. The present writer is one of them. He has not requested shore duty, and believes he is justified in saying that he was selected for the

duty he is now performing. His last promotion came in the middle of a cruise, so he is ineligible by two months' service.

The percentages suggested in this Section correspond quite closely with what would be the actual percentages if the inequalities of promotion mentioned in the memorandum were rectified and the staff officers concerned were abreast of their running-mates; and this was undoubtedly the guiding feature in setting these new percentages. Speaking of the Navy as a whole, the suggested percentages are apparently equitable ones right now. At present, equity in these proposed additional numbers is vested in the delayed staff officers, *most of whom would be ineligible to promotion under this bill.*

SECTION III provides that the existing inequities shall be carried over into the reorganization.

SECTION IV. Aside from recognizing conditions which in a Navy-wide sense already exist in regard to precedence, this section admits inequalities of promotion and makes no effort whatever to equalize them. It provides that the present practice shall continue. *When* the delayed officer is promoted, his date of precedence will again govern. As Section VIII minimizes chances of such promotion condition (b) of the memorandum is not furthered.

The fourth paragraph of this section distinctly states that officers who have been held back behind their relative length of service as noted shall in the future have no grounds whatever for expecting any relief. They have been held back by "operation of existing law."

SECTION V. This section contains one oddity—Paragraph Three. A good rule in law is that where specific mention is made of one thing, things not mentioned are not contemplated. The staff officers who are presumably allowed to decide whether or not they will remain straight specialists are told that unless they now have the rank of captain, they may be ordered as executives and commanding officers whenever the Department sees fit, even in the absence of qualification. Of course this is not contemplated, *but in the case of at least one former engineer officer, exactly that was done!*

Under SECTION VI, a junior staff officer has his choice of speedy elimination or of lifelong competition in strange lines with men with six to ten years' start of him.

SECTION VII does not state who is to be the judge of a staff officer's qualifications. Presumably it is to be line seniors. Under this Act, for a considerable period, the average line senior will have less knowledge upon which to base his judgment in technical matters than will the officer whose record is being marked. The same thing is true to a large extent today, and works out equitably in the long run, but it is not exact. Many semi-annual reports have carried 4s, where a staff senior would have awarded a 2.5, but many 2.5s have been put down for work which would have gained rapid promotion from a shore-going corporation of

business men. At present, this system works pretty well; but under the proposed bill it becomes vital to the career of a great many officers.

SECTION VIII is the method of "elimination" noted by Commander Fisher. For a few years, members of the present staff corps will be necessary to bridge the gap which will exist while the new line is learning its new duties. Senior assistants and division chiefs of Bureaus will be necessary. No person can say that the average commander or lieutenant commander of the staff can expect much promotion between now and 1928—apparently less chance than at present under this proposed bill—yet in 1928, the age-in-grade would automatically eliminate practically the entire Supply Corps down to and including No. 39 on the lieutenant commanders' list.

SECTION IX mentions "preference." It makes no provision whereby this preference shall be in any way controlling or permanent. Let us word this section a bit differently: "Preference shall be given to officers of the old line in the appointment of the Chief of Bureau of Navigation." Why is not this as necessary as the Section given?

SECTION X again repeats existing conditions. If anything, the percentage of former pay clerks and carpenters now holding commissions is greater than that of any other class of former warrant officers.

SECTION XI does not appear germane to the subject of the Bill. Congress has not hitherto seemed to like the idea of "once a Bureau chief always a rear admiral," and when exceptions have been made, they have been specific and for cause.

SECTIONS XII and XIII are fairly well covered by Commander Fisher, and it is noted that the impartial attitude slips a little in his discussion.

In general, the Bill provides an excellent agency for eliminating, not the difficulties of the Navy Department, but most of the individuals now in any sort of difficulty in regard to their future. The solution offered appears to be that each one will better resign or retire as soon as possible, and take his difficulty out with him. Specialty duty is to be facilitated by removing those who have up to now specialized seriously. It is noted in the memorandum, for example, that age-in-grade will be to the immediate advantage of the present staff. It will indeed, under this bill. It would save practically every lieutenant commander and commander of the present staff from five to twenty years active service in his present grade before retirement!

Following Commander Fisher's excellent plan to provide some constructive criticism, the suggestion is offered that over ninety per cent of the personnel difficulties of the present are due to the fact that while the line receives an annual, regular increment at the bottom, the staff does not. I firmly believe that these troubles, together with the most of our misunderstandings, would vanish if the three staff corps involved, as well as engineers, aviators and gunnery officers, were Naval Academy graduates, trained for their specialty by postgraduate work at Harvard, Technology, Pennsylvania, or Columbia. If further amalgamation of *officers* is

desired—the duties will not amalgamate—it should be simple by guaranteeing to each specialist specialty duty only, equitable promotion wherein each specialty would have its allowed percentage in each grade, and equality in all other respects. This is apparently the only businesslike sort of amalgamation, and it requires no special bill. The Uniform Regulations and the names of the Corps will need changing, but that should not require much effort.

Naval Corps, Specialization and Efficiency

LIEUTENANT COMMANDER T. C. KINKAID, U. S. NAVY.—In order to clear up certain points in my article "Naval Corps, Specialization and Efficiency" in the September number of the Naval Institute PROCEEDINGS (Whole No. 235, Page 1491), I respectfully submit the following comments on the discussion of that article by Captain Elliot Snow (C.C.) which appeared in the January number of the Naval Institute PROCEEDINGS (Volume 49. No. 239, page 120).

The original article deals essentially with the education and training of officers and outlines a proposed career to be followed by officers through the various grades of promotion. In this connection, the article recommended amalgamation of the construction corps, abolition of permanent engineers and, generally, reducing the number of corps in the Navy. Captain Snow objects to the amalgamation feature and to one or two other points, but states that some of the suggestions in the article are constructive.

In regard to the selection of staffs by flag officers, the article does not in any way intimate a "lack of judgment of flag officers" in making these selections. On the contrary, flag officers select for their staffs young officers with whom they have served and in whom they have confidence, and, except in rare cases, a high type of officer is selected for this duty. The point is that there is not in existence any special course of instruction or practical experience which specially fits an officer for staff duty, except staff duty itself, and there are no adequately trained officers from whom the flag officer can make his selection. Special instruction and training is essential for efficient performance of staff duty and this instruction and training is not given to any group of officers at the present time. In order to obtain a trained staff, a flag officer must select officers from those who have had previous service on another staff and such officers may be later called to account by the selection board, as too much staff duty is not looked upon with favor.

Great benefit would accrue to the service if, after general line course a number of officers were put through what was called in the original article an "administration course." This course should include organization and administration, ashore and afloat, strategy and tactics, and communications, and would be of great benefit to officers who later served on a flag officer's staff, or in other specialized capacities. "Communications"

has been well organized for some time with the result that quite a number of specialists in communications have been produced—"specialists within the line." Knowledge of organization and administration can be gained by study and experience. Tactics, as an important feature of an officer's education and training, has suffered outrageously as compared with gunnery and engineering, for lack of an organization with an aggressive leader who has "punch" enough to put tactics on the map. Tactics must be organized. A staff officer should be more or less expert in all of these subjects *before* he goes to a staff and not get his education and training at the expense of the command he serves.

To clear up any seemingly "contradictory elements" in the article let it be said that I am very definitely in favor of specialization *within the line* and definitely opposed to specialization by naval corps, with a few exceptions of which the construction corps is not one. Specialization is essential; naval corps are not essential or even advantageous.

An engineer corps could not possibly have avoided the difficulties in engineering afloat which followed the war. These difficulties were a direct result of the hasty demobilization which took place. Ships' complements were changed overnight; officers and men were demobilized arbitrarily without regard to the effect on the organizations of which they formed a part; ships were de-commissioned on a moment's notice without sufficient personnel to do the job properly; new ships were laid up before they had been decently commissioned.

In other words, the demobilization was not planned: it was effected by arbitrary order, probably because of pressure from Congress, and the ships suffered in all departments, not only in engineering. Ordnance had great difficulty in accounting for its material and missing surveys poured into the bureau although in most cases the material had been turned into store or properly expended but had not been accounted for on paper. All bureaus had troubles of this type because of inexperienced and constantly shifting personnel. Some destroyers in reserve, or part commission, were commanded by ensigns or lieutenants (jg) with very little experience to their credit and some destroyers had a dozen or more different commanding officers within a year or eighteen months. It is little wonder that, under these conditions, machinery was not properly cared for in idle ships or properly laid up when ships were de-commissioned. Upon being recommissioned a few months later deterioration had taken place and thorough overhaul was necessary before any extended cruising could be done.

The writer does not for a minute imply that a line officer today is better qualified to do the work of the construction corps than is a naval constructor. The point he wishes to make is that a "specialist within the line" should be able to do this work somewhat better than a naval constructor because of his experience operating ships at sea, and that the services of this officer would still be available to the line. "Economy" is the watchword of the hour and economy in personnel, where it can be effected without loss in efficiency, is a matter to be given due consideration.

The Navy is allowed only so many officers. To divide this number into several corps is poor economy.

The writer has recently seen a recommendation that an officer of the supply corps be attached to each destroyer operating away from its squadron organization. This brings to mind an extreme case. Suppose we should organize all the corps that would be formed if every recommendation in this connection were followed. We would have engineers, naval constructors, ordnance and gunnery officers, supply officers, navigators, medical officers, and line officers, not to mention aviators, civil engineers, etc. Then consider that the total number of officers in the service is sufficient to allow six officers per destroyer. Then put an officer of a special corps at the head of each department on the destroyer and see what is left. The commanding officer would stand watch and watch with himself. If a supply officer is put on each destroyer, a line officer must be removed and a line officer is of far more value to that type of ship.

The files of all bureaus in the Navy Department are undoubtedly full of "conflicting recommendations that have been made by seagoing officers," some of them diametrically opposite, but this could hardly be held as proof that experience at sea is detrimental to or stultifies the minds of those who have to do with the design of naval material. It is quite true that "the experience gained by a wide-awake young officer on a submarine or destroyer has little value on the design of a turret or a stabilizer." However, the Bureau of Ordnance has found it to be an excellent plan to have at its various desks officers who have taken the ordnance course and who have served afloat with the particular type of material coming under their respective desks. Experience as turret or gunnery officer is of great value in laying out a new type of turret or in inspecting the plans of a turret. In the same way the experience gained by a wide-awake young "specialist within the line" on a submarine or destroyer would be of great value in the design of a submarine or destroyer.

Conflicting recommendations are to be found within all units in the Navy and are not confined to the lines' recommendations on technical subjects. Such conflicting recommendations occur within each group of specialists and within each bureau and are the foundation upon which progress is built. Ward room argument, so often characterized as a "positive statement and a flat denial" is often productive of valuable results due to the efforts of the adversaries to prove their points. Good, healthy argument is a means to real advancement. It is only necessary that we all speak the same language and understand each other's point of view. Progress would be slow indeed if all thought the same things and failed to make any conflicting recommendations.

In this connection the recommendations of specialists of any kind are often open to grave criticism because they are liable to follow a single-tracked line of thought and to fail to give due consideration to surrounding conditions or outside influences. The recommendations of experts are

not infallible but should be examined and criticized by non-experts with open minds who can view such recommendations from a broader point of view. Expert advice is extremely valuable, in fact essential, but it can not be followed implicitly for the above reasons. If all our specialists were "specialists within the line" we would not eliminate the conflicting recommendations but we would have expert advice tempered by knowledge and experience of the practical considerations that have so great a weight in the design and supply of material.

The state of material in the Navy today is of course the result of "development" rather than of "initial design" and this state of material combines the ideas of both experts and non-experts. The function of the bureau having cognizance is to weigh and co-ordinate ideas and recommendations from whatever source they may emanate, in addition to producing original ideas of its own. The author was not unmindful of this when he wrote the paragraph quoted in the discussion and still believes that "The design of new material may be divided into two general functions; first a clear-cut statement of what the mechanism is to accomplish, giving its general characteristics, followed by a critical inspection of the actual designs; and second the actual calculations and arrangement of parts.

In order to refute the idea that "the author possesses a meager knowledge of what his neighbor is doing" and to illustrate the above statement, the functions of designing a piece of new material may be described. In 1913 a satisfactory range keeper was badly needed. The officer having the fire control desk in the Bureau of Ordnance gave a "clear-cut statement of what the mechanism was to accomplish, together with its general characteristics," to Mr. Ford of the Ford Instrument Company, who was an expert in mechanical design although at the time he had practically no knowledge of fire control. Mr. Ford made "the actual calculations and arrangement of parts" and finally produced a remarkable instrument. The designs of this instrument were subjected to "a critical inspection" and the first instrument was thoroughly tested and inspected not only by officers from the Bureau of Ordnance but by many other officers who made useful suggestions and criticisms, after which the instrument was modified and sent to service for test on board ship. Thus a piece of "new material" came into being without the supervision of a corps of specialists.

In case of redesign or development of old material, the same principles are followed using the earlier design as a basis upon which to work. Operating personnel must state the requirements and make the inspections and final tests, while designing engineers make the actual calculations and arrangement of parts. Special corps are not necessary to design or produce material for the Navy and certainly better teamwork does not result from having such corps. One bureau must be responsible for the final design and production of a particular type of material co-ordinating all available ideas, but there is no reason why that bureau has to be run by a special corps. If the construction corps were amalgamated, the Bureau of Construction and Repair would still be responsible for the

structural strength and stability of our ships but it would function under "specialists within the line" not under naval constructors of a special corps.

Notwithstanding the above statements and the recommendations made in the original article, the author recognizes the excellent work done by the construction corps in the past and has a great respect for the results attained by that corps. Furthermore, the author has on several occasions greatly appreciated the courtesy and tact displayed by members of the construction corps in their consideration of ideas submitted by himself or other line officers. The officers of this corps would be a real addition to the line and they would become "specialists within the line." Other specialists in naval construction would be educated and trained according to the plan outlined in the original article. They would be line officers first, and specialists in one particular line secondly. A line officer should have a thorough general knowledge of all technical subjects and a thorough detailed knowledge of one specialty.

The Art of Ship-Control

(See Page 587, April, 1923, Proceedings)

Lieutenant L. Wainwright, U. S. Navy.—I want to express my appreciation of Commander Stiles' well conceived and charmingly expounded article. My limited experience has amply convinced me of the usefulness of the kinks he describes, and of the wisdom of his criticisms and suggestions.

On my last battleship the captain saw fit to detail me as "tactical officer," in addition to other things, with duties which were at first not entirely delineated, but which before long came to constitute a clearly defined unit in the ship's maneuvering organization. I was nominally an assistant to the navigator, charged with an expert knowledge of certain standing orders and the manipulation, personally or through assistants, of the several devices for ascertaining relative position and determining course and speed. Another officer was assistant for keeping track of the ship's navigational position. The navigator co-ordinated, and when necessary supervised, these two activities.

During all tactical or gunnery maneuvers it was my business to be at hand on the bridge or in the conning tower, and to have available all the assistants and instruments necessitated by the nature of the exercise in progress, a duty which my principal detail as communication officer always permitted. In effect, I was a technical assistant to the officer-of-the-deck, who was thus saved the necessity of concentrating on these matters, and was consequently freer to handle the general situation.

It should be stated with emphasis that my status in no whit displaced that of the officer-of-the-deck, for it was of the same purely advisory character as the navigator's. However, this subdivision of functions proved most satisfactory and efficient, and may be commended to others. As a

minor, but practical, consideration, I may add that being on hand for all maneuvers, with only occasional exceptions, worked no great hardship with respect to hours on duty, attendance at meals, and performance of other duties. Certainly, no more so than in the captain's case.

It soon became evident that a large majority of the deck officers held the Battenburg Course Indicator too complicated to understand *satisfactorily*. Incredible though this sounds, and unjustified though it be, it is nevertheless a fact. I can fully sympathize with the point of view, for it was precisely mine before my new duties forced me to appreciate the real simplicity and utility of the instrument. Perhaps this feeling could be obviated were the instructions clearly to set forth the simple ways in which the properties of similar triangles apply to the various classes of problems. The underlying idea once grasped, there is no need to memorize rules.

The Battenburg Course Indicator is well adapted to making S. R. B. P. approaches, though many officers prefer substitutes. In making such approaches, it was often desirable to obtain ranges from the after secondary range finder, while the bearings were taken at the conning tower. The distance between the two stations introduced a parallax for which it was found necessary to correct in order to insure coming within a small tolerance of the prescribed range abeam. To do so, it was found sufficiently accurate to correct the range finder readings by the product of the distance between stations and the sine of the angle by which the target bore forward of (abaft) the beam. The rule is then turned right side up and to determine. A simple graph would serve, but it was found convenient to calculate it on a 5in. slide-rule. The runner is set for the constant distance between stations. When it is desired to compute the correction, the rule is turned upside down and the S *(sine)* scale brought to the angle forward of (abaft) the beam. The rule is then turned right side up and the correction read from the upper sliding scale at the line on the runner.

The slide-rule is also handy in estimating time to reach position, etc., and saves having a small collection of curves which would be less convenient to carry about.

The Battenburg Course Indicator is not well adapted to work involving accurate account of turning circles. In other words, it falls down when curvilinear elements cannot be sufficiently well approximated by straight lines. I have found it convenient, when something small and portable is required, to fit a mooring board diagram with a graduated radial arm. Turning circles are then predicted to scale, and plotted as executed, with the result that the time consumed in getting about to make another run is reduced extraordinarily. In practice runs on a drifting target when the base course is immaterial, a circle drawn in ink about the center of the board with a radius equal to the prescribed range abeam, makes it easy to draw the new base course which can be most profitably assumed. It is, of course, a tangent to the ink circle from the point plotted at the completion of the turn. My recollection is that by using this

method we made about twice as many practice runs in the same time as other ships which apparently employed less advantageous means.

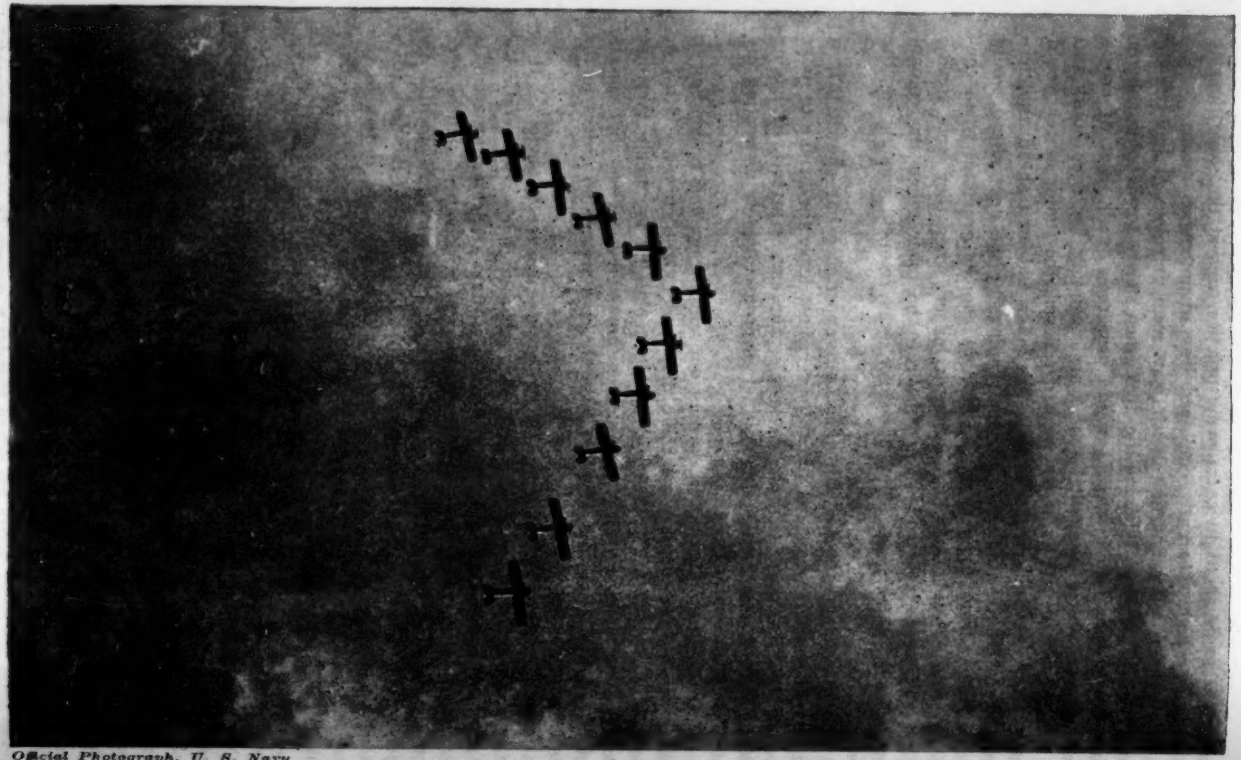
One wrinkle, which at first blush may seem frivolous, I have found quite practical. Before relieving the deck when steady steaming in column formation was to be expected, I would prepare a small sheet of cross-section paper with a horizontal time scale extending for four hours and a vertical scale in yards. When we had relieved, the junior officer would run two curves of our distances from the guide and next ahead as determined by stadimeter. The stadimeter readings of the next ahead would be made at uniform time intervals, varying from half-minutes when conditions were unstable, to two minutes, or longer, when they were steady. The readings for the guide would have to be made when the column was sufficiently staggered, which, however, was frequent enough for the purpose.

This procedure may sound tedious, but experience has shown that it is not. At such times as the junior officer must leave the bridge to make inspections, I found no difficulty in keeping the curves myself, by having the annunciator watch call time, without disproportionately distracting my attention from other things.

The behavior of the ship in opening out, closing up, and responding to changes in revolutions, is remarkably displayed by the curves. *"Must be seen to be appreciated."* As changes in revolutions are made they are recorded on the curves, and become astonishingly few. The relief officer-of-the-deck can grasp the situation instantly, and wastes no orders to the engine room in getting the feel of things.

One reason for the advantage of using these curves is obvious. It is a well-known psychological fact that one's sense of time varies erratically. Consequently, it is impossible for the mind to attain and retain an accurate conception of the rates (with respect to time) at which the distances, etc., are changing. When these rates are high and variable, the mental approximation often becomes so unreliable that the officer-of-the-deck loses confidence and gives unnecessarily frequent and numerous orders to the engine room. Such occurrences are commonplace. The curves relieve the mind of the necessity for making such judgments.

I never had occasion to apply the scheme to line of bearing formation, but I would suppose it applicable. Perhaps our radio experts could make the curves appear automatically by gearing up the inter-fleet radio to the submarine oscillators and deriving the distance from the difference in phase of the two wave trains as received from the guide which would transmit them in phase. Of course, if this were done, means would have to be provided to prevent an enemy from utilizing these radiations for deducing ranges and bearings.



Official Photograph, U. S. Navy

ELEVEN NAVAL PLANES IN A PERFECT "V" FORMATION

PROFESSIONAL NOTES

PREPARED BY

LIEUTENANT COMMANDER F. W. ROCKWELL, U. S. NAVY

AND

LIEUTENANT J. B. HEFFERNAN, U. S. NAVY

GENERAL ARRANGEMENT

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GREAT BRITAIN

NEW BRITISH SUBMARINE WILL BE LARGEST AFLOAT.—The mysterious British submarine *XI* nearing completion at Chatham will be, when finished, the largest and most powerful underwater war-craft in the world, it is said here today.

On the surface she will displace 2,780 tons and submerged 3,600. The latter displacement is 1,490 tons greater than the largest German wartime submarine. It will be almost as great as that of the *Caroline* class of British light cruisers.

The new submarine will probably mount 12-inch guns, which will make her more than a match for many surface warcraft. Britain has already commissioned the *M* class of submarine, which mounts a 12-inch gun. The first of these was completed shortly before the armistice. The gun fires with the muzzle just projecting above the water and is sighted by sighting the submarine itself.—*Baltimore Sun*, 20 May, 1923.

THE ONE-POWER STANDARD.—It is clear from the manifesto by the Navy League, on which we commented recently, and from other indications, that the naval outlook is viewed with some misgivings by a section of the public. That the British Fleet has already declined to second rank is a statement heard so often nowadays that it is coming to be accepted as a truism. Nevertheless, we cannot agree that the facts justify this pessimistic conclusion. In the first place, it is incorrect to assume, as so many people do, that the passing of our supremacy afloat dates from the Washington Conference. Months before the invitations to that gathering

were issued, the British Government had announced through the First Lord of the Admiralty, its decision to abandon the old formulas which had governed the dimensions of our Fleet for so long a period. In the Estimates of 1921-22 the new policy was laid down as that of being equal, in capital ships, "to the strength of any one other naval Power." This, of course, was the one-Power standard, and as the American Navy was the only one which approximated in strength to our own, the First Lord's statement obviously meant that we should be content henceforth with a battle fleet no larger than that of the United States. What the Conference did was not to initiate this principle, but to confirm it. We are told, however, that the one-Power standard is not being adhered to, that the United States now leads in big ships, and that consequently "the trident has passed out of our hands." On a mere tabulation of tons and guns that argument might be sustained, though only by ignoring the two battleships now building in this country. And even if the two fleets are compared as they stand, no impartial critic could fail to reckon as a factor of great importance on our side the presence of four battle cruisers, a type unrepresented in the American Navy. Moreover, our ships as a whole are superior in speed, and all carry guns of 13.5-inch caliber or more, whereas four of the American units have only 12-inch guns.

But this narrow method of computing naval strength is somewhat out of date. It disregards war experience, which taught that the great ship, though an indispensable element, is not the only one that makes for sea power, and that unless a fleet has its proper complement of other types, it cannot hope to perform its functions with full effect. Taking this broader view of the matter, who will have the hardihood to assert that the United States Navy is better equipped for war than our own? Strong in battleships and destroyers, it is deficient in everything else. For the purpose of fleet scouting, commerce protection, and the many other duties which can only be effectively undertaken by fast cruisers, it has one ship in service and nine others completing, where as we have upwards of forty. The aircraft carrier, by common consent, has become a most necessary adjunct of any efficient naval organization, yet of this type the United States has but one ship ready—a converted collier, of low speed—and two building, against the four large, fast, and powerful units under the White Ensign. That we are behind with destroyers must be admitted, and we have frequently expressed regret at the wholesale scrapping of valuable boats which followed the armistice. In submarines also we are numerically inferior, but so far as ocean-going boats are concerned there is little to choose between the two navies, most of the American submarines being of the coastal class, which has neither the sea-worthiness nor the radius required for deep-sea cruising. As regards personnel, a great deal is made of the fact that the American total comes to several thousand more than ours, though if we deduct the U. S. Marines, of whom less than ten per cent are trained for service on shipboard, the advantage will be found on the British side. It should, further, be noted that the entire aviation personnel is included in the American establishment, instead of being additional thereto, as is the case in our Navy. In commissioned officers the American Navy has a majority, but only, we believe, in the non-executive branches. In petty officers, seamen, and Marines the two navies are practically equal, any difference being in our favor.

But with personnel, far more than with ships, mere numbers are misleading, and if the respective establishments are compared on the basis of length of service—or, in other words, professional proficiency—there can be no question as to which of the two fleets is in the better position. It is unnecessary to repeat here the illuminating figures on this subject which have previously appeared in our columns, but those who desire to form a sound

estimate of relative strength in personnel should consult *The Naval and Military Record* of January 24 last, in which the relevant facts were fully set forth. We need only repeat the opinion expressed at that time, to which we still hold: viz., "that although the United States Navy may have a paper margin of superiority in numbers, the balance is more than adjusted by our longer period of service and greater continuity of training." In the matter of Reserves, too, we are "infinitely better off, both as to numbers and average efficiency." Finally, the British Fleet enjoys an indisputable advantage in strategical mobility, thanks to its unique chain of bases and fuel stations, which would enable it to fight and maintain itself in practically every quarter of the globe where British interests are to be defended. The United States Navy, on the other hand, having no oversea bases on which it could depend in time of war, would be more or less tied to its coasts and unable to protect American interests if they were assailed, for instance, in the Far East. We need scarcely say that nothing invidious is intended in the above comparisons, which are merely cited to disprove the oft-repeated statement that British naval power is a thing of the past. Deficient as it may be in some respects, and inadequate as it certainly is to cope with the manifold commitments of a great Ocean Empire, the Navy of today is, on the whole, fairly up to that one-Power standard of strength which is now the official policy of the British Empire.—*Naval and Military Record,* 25 April, 1923.

SINGAPORE.—The decision of the Admiralty to spend eleven millions sterling upon the development of Singapore, as disclosed in the Navy Estimates for the current year, has called forth a great deal of criticism. It seems such a lot of money to devote to any one feature of naval preparation in these piping days of peace, and much less piping days of urgent economy. What justification is there for such a colossal outlay?

It may be claimed for the Admiralty that no Government department has shown a more loyal and consistent appreciation of the necessity for retrenchment since the armistice. Therefore it is at least reasonable to assume that the Admiralty is well satisfied as to the desirability of this heavy outlay. Moreover, the proposition really sounds much more formidable to the taxpaying mind than it will actually prove. For eleven millions is the total estimated cost of the work to be undertaken and this will be spread over a number of years. During the current financial year the outlay which will be incurred in connection with the Singapore project is about $200,000.

The Singapore decision appeals to me as an act of sagacious foresight. The little island laying off the southern spur of the Malay peninsula is, in fact, the natural strategic hub of the great Pacific zone. It is the meeting points of the limits of three of our overseas naval stations: the China, the East Indies, and the Australasian. Behind it, considered in the light of any potential objectives, lies the Africa Station.

With that rapidity of transformation which is characteristic of the changes in naval rivalry, the "center of gravity" shifted on the conclusion of the war from the North Sea to the Pacific. The European navies ceased to occupy premier place in the strategical vision of the British Admiralty. The fleets of the United States and Japan, which had suffered comparatively little during the prolonged struggle, were the two paramount forces in sea power. The conflict of interests and ideals between the two nations lent an enhanced significance to the big programs of new naval construction upon which each had embarked. America transferred the bulk of her Navy into the Pacific. Australia called aloud over her vulnerability amid this new order of things.

The Admiralty sent out Lord Jellicoe to study and report upon the

strategic situation. It is now a matter of history that he proposed the formation of a powerful Imperial Pacific Fleet. Viewed in the light of the principles which have always guided our distribution of naval power, he was indubitably right. But political considerations had to be taken into account. The Pacific zone is only of consequence to ourselves owing to the activities of the American and the Japanese Navies. Any big concentration of our warships in that ocean must needs have direct reference to those navies. A policy which pre-supposed action on the part of America directed against British interests, when there was not a particle of evidence to suggest anything of the sort, would not have received sanction in this country. Japan was our very good friend, still bound to us by treaty. Any formidable grouping of ships inferentially directed against her would have been purposelessly provocative.

So the Pacific Fleet proposal was quietly slipped into a pigeon-hole at Whitehall. Nevertheless, the Admiralty realized that Lord Jellicoe was perfectly right, speaking from the viewpoint of naval adviser. So they compromised, and in this compromise we find the *raison d'être* of the Singapore scheme. Also we find the controlling factor in the design of the two new capital ships, *Nelson* and *Rodney*. When these vessels are completed we shall possess a very powerful flying squadron, including the *Hood, Repulse* (reconstructed since the war), and *Renown* (to be reconstructed).

These vessels are all capable of steaming 30 knots, and are all armed with 15-inch guns (the two new ships will probably mount 16-inch guns). This means that they could get from England into the heart of the Pacific zone in about twenty days. Such mobility is tantamount to pretty good substitute for the permanent maintenance of a fleet in those waters.

But a powerful fleet without an adequate base is a sure hostage to failure and disaster. In fact, one may go further, and say that it is an impossibility. Bombay can dock a Dreadnaught. So can Hong-kong. But these places are too remote, too much beyond the fringe of the Pacific zone, to be of any value in the strategic calculations.

Singapore is geographically ideal as a naval Pacific rendezvous. Moreover, it is liberally endowed by Nature for the purpose. In the sheltered roadstead to the north-east of Blakang Mati Island there is an average depth of ten fathoms. Keppel Harbor, with its breakwater, affords perfect shelter against any weather, only it is not deep enough for modern battleships, and a big dredging scheme is part of the Admiralty project. The *Renown*, when she visited Singapore with the Prince of Wales on board a year ago, was obliged to anchor outside of the breakwater.

Very rich oilfields lie within easy distance of the place, and it is proposed to establish an immense fuel depôt. The old Tanjong Pagar Docks are too small to take anything beyond a light cruiser, but the new King's Dock can accommodate any existing British warship with the solitary exception of the *Hood*.

Apparently the new naval works are to be of a permanent character. That is to say, they will consist of massive stone quays and masonry docks. This is the one feature of the scheme which seems open to criticism. Floating docks are so much more economical and so adequate in all respects that the general view appears to be they will entirely supersede permanent docks in future developments. Singapore offers excellent shelter for the mooring of such structures. Furthermore, the place lends itself to defense by means of artillery, mines, and submarines so effectively that it is difficult to believe that a hostile fleet would dare to approach it to within attacking distance.

Singapore is the strategic key to the defense of Australia. The idea is to develop it as a great submarine and aircraft base, but with adequate

accommodation to meet the requirements of a battle fleet in case of necessity. So long as we seek to maintain our position as a great sea Power, so long must our Admiralty keep pace with the naval progress of other nations, in whatever part of the world this may be going on. It will be only possible to desist from this policy when, in an incredible wave of sanity, the whole of mankind agrees to beat its war weapons into ploughshares.

Therefore in view of the great change in the international balance of naval power which has come about since the war, the Singapore scheme is essentially a sound one.—Sir Hubert Russell in *Naval and Military Record*, 11 April, 1913.

BIG COMMONS VOTE FOR SINGAPORE.—The government had an easy Parliamentary victory tonight when George Lambert's motion to reduce the naval vote, as a protest against the expenditure of £11,000,000 to complete the naval base at Singapore, was defeated in the House of Commons by 253 to 94.

Mr. Lambert, who was a Civil Lord of the Admiralty from 1905-15, maintained that the Singapore scheme was "flouting the League of Nations" that it was wrong to scatter, instead of concentrate, the fleet, and that the new base would be a hostage to any possible enemy. He asked whether the scheme was not an attempt to get behind the Washington treaty, which forbade developments at Hongkong, but did not forbid them at Singapore. He characterized the project as "absolute madness," leaving vulnerable strategic establishments all over the world, while London was not guarded against aircraft attack.

The Labor members strongly denounced the scheme, arguing that it must be directed either against America or Japan. Speakers for the Government pointed out that it was approved by the imperial conference in 1921 and strongly recommended by the Committee on Imperial Defense and by both the late and the present Cabinets.

Bolton Eyres-Monsell, Financial Secretary to the Admiralty, defending the plan, contended that the Washington Conference made this work increasingly necessary, because, under it, Great Britain was precluded from developing further at Hongkong, and had not a single dock in the Far East on British territory capable of receiving a capital ship.

The opponents of the Government made a great play of the argument that a decade hence naval warfare might be so revolutionized that the capital ship would become obsolete, and characterized the plan as a speculation and a gamble.

S. E. Derbyshire, opposing the plan as an infringement of the spirit of the Washington treaty, thought that it would merely encourage the United States to follow suit and develop Pearl Harbor and Honolulu.

Carlyon Belairs, supporting the project on the ground of its value in the event of an unfortunate difference with Japan, argued that Singapore might ultimately be useful to the United States in defending the Philippines, which she was not developing herself. Nobody supposed that Great Britain or the United States would seek war with Japan, he said, but nobody could be sure that the military party might not come to the front in Japan.

"Command of all seas," the undeviating British naval policy, was the ideal set forth by Lieutenant Colonel L. C. M. S. Amery, First Lord of the Admiralty, in defending the Government proposals.

"Command of the seas was what won the Great War," he said. "but we do not possess such command. We are not in a position today, nor shall be for many years to come, to put a battle fleet in the Pacific or even as far as Singapore. In all these waters, with their immense con-

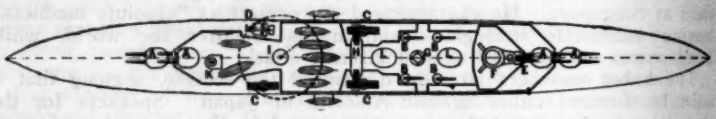
sequences from a strategic viewpoint to the whole empire, we are helpless and reliant on the good-will of a friendly and lately allied power. But no self-respecting power can afford indefinitely to be dependent on another power for its security, and even its existence."

There could be no suggestion of menace to Japan or any idea that Great Britain contemplated danger from or strained relations with Japan or any other great power Colonel Amery said. If there was any such idea Britain should not proceed so leisurely.

He disagreed with the view that the battleship would become obsolete, contending that the basis of all the discussions at Washington, on which the great naval staffs had been unanimous, was that the battleship would remain for as long a future as one could forsee the main strength and pivot of naval battle. Colonel Amery gave details of the plan, showing that Singapore was to be made a base capable of holding the largest capital ships, and fortified with guns against possible raids.—*Associated Press,* London, 1 May.

FRANCE

DECK AND GUN PLAN OF NEW FRENCH 8,000-TON CRUISERS.—A: Double gun turrets, 155 mm. B: Anti-aircraft battery, 75 mm. C: Triple Torpedo tubes. D: Scouting plane placed over the fourth Torpedo tube. E. Conning tower. F: Tripod mast and fire control top. G: Standard compass.



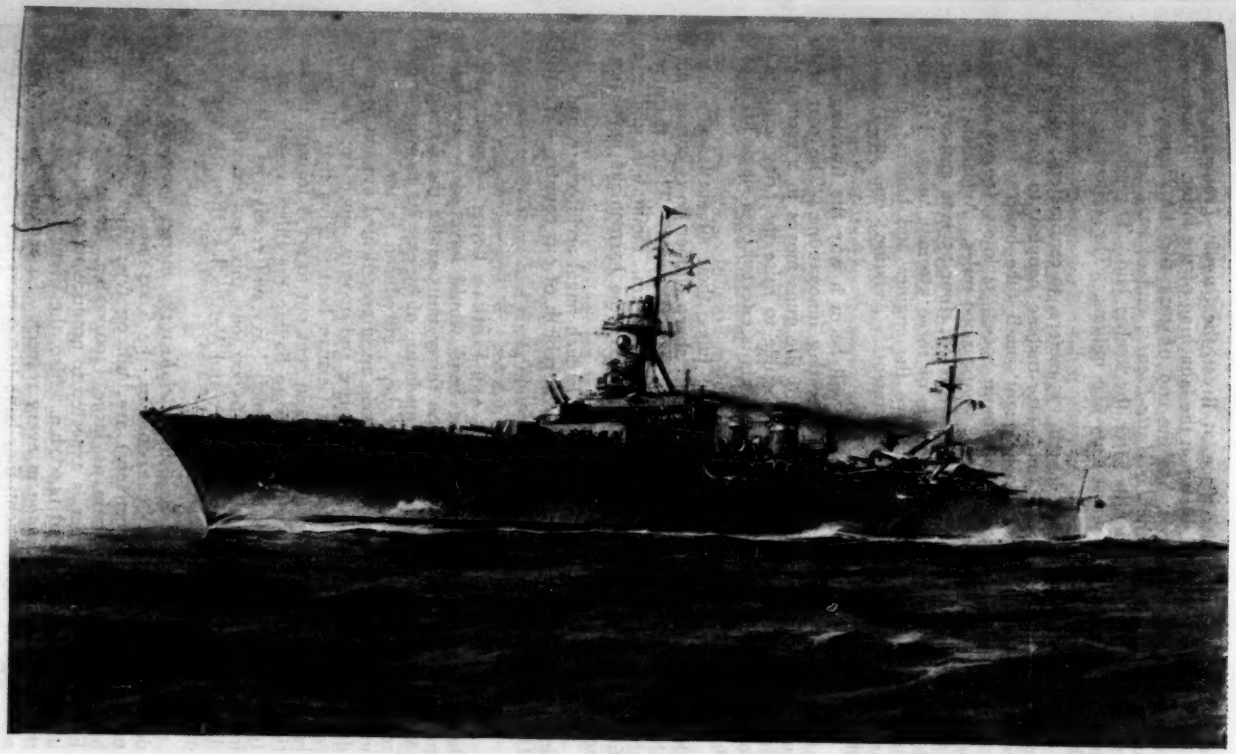
DECK AND GUN PLAN, NEW FRENCH CRUISER

H: Searchlight platform. I: Crane for handling boats and plane. K: Protected platform, aft. L: Smoke stacks. (Note that the after protected platform "K" and main mast are slightly to starboard of center line of ship. This disposition is intended to make it difficult for the enemy to take the angle of the cruiser's course).

OUR NEW LIGHT CRUISERS.—It is true that our navy no longer counts many battleships; the construction of those begun in 1914 has been abandoned; so that only those prior to 1913 remain. Their masting has recently been modified; the light and rather low masts which they had when they entered the service have been substituted by tripod masts offering a more solid base and facilitating a greater height for long range fire control tops.

What will be the navies of tomorrow? Will there really be such—in the true sense attached to that word—in the European seas that are relatively so narrow that artillery projectiles, and even more easily bombing planes can cross in some places? At any rate, these narrow seas are furrowed by numerous merchant ships which maintain the commerce of neutrals and supply belligerents with provisions, munitions, raw materials, and transport troops. This intense traffic has to be supervised. Three ships for that purpose have been included in the naval program now being executed. They have been named *Duguay-Trouin, Primauguet* and *La-Motte-Piquet.*

The *Duguay-Trouin* was begun at Brest on August 4, 1922; and will be launched next September. The *La-Motte-Piquet* was begun at Lorient, on January 19, 1923, in a dry dock, that is to say in a dock which it will suffice to fill with water in order to float the ship. This procedure will make it possible to complete it almost entirely before launching.



NEW FRENCH LIGHT CRUISER OF 8,000 TONS. See page 1182 for description.

The *Primauguet* will replace, at Brest, the *Duguay-Trouin*, in the dock which will become available upon the launching of the latter. The probable time of entry into service is; the end of 1924 for the *Duguay-Trouin*; beginning of 1925 for the *La-Motte-Piquet*; end of 1925 for the *Primauguet*, or about thirty months after the keel is laid. The price of each of these ships will be about seventy-five millons. The following are their characteristics:

Displacement, 8,000 tons; length, 175 meters, 30 centimeters; width, 17m., 20; draft, 5 meters, 30; four motor-turbine coupled to four reduction gears, driving one screw each; eight small tube boilers, fuel oil only; total power, 100,000 horse; maximum speed, 34 knots (62.968 kilometers per hour); radius of action at 15 knots, 4,000 miles. Armament: 8 guns, 155 millimeters in four double-gun turrets; four 75 mm. anti-air guns on deck; four torpedo launching outfits of three 550 mm. tubes. Protection: light armor on the sides and above the engines and boilers; close cell arrangement of watertight compartments. Aviation: one small scouting plane.

In addition to the plane, which will be in a way the traveling pigeon of the ship, these ships offer interesting innovations. The part of the turret wall traversed by the barrel of the guns moves in a vertical plane during the pointing and makes it possible to raise the firing angle to the maximum. The launching of deck boats is effected by a single lift fixed to a pivoted derrick.

These cruisers have very beautiful lines, their silhouettes are elegant, they poise well on the water and their sharp clipper bows curving out at the upper part will facilitate running at high speed. Their sterns recall those of motor boats, of big racing cruisers, facilitating gliding and fit for high speed. As a whole they give the harmonious impression of solidity and equilibrium.

These three cruisers do honor to French naval architecture, and we see in them the first elements of the naval rebirth of our country.—Translation from *L'Illustration*, 14 April, 1923.

Compared Worth of Cruisers and Flotilla Units.—Considerable delay, which greater energy at the head would have easily avoided, has presided over the command of the thirty units under the Naval Vote of April, 1922. The delay has been made use of by experts to improve plans: several minor ameliorations have been introduced in the armament and motors of the new ships that embody an unprecedented amount of realistic data, gathered in the war, and also, and mostly, since the war, in the course of comparative tests in ex-German boats. Now that all contracts have been awarded, orders have been sent out to press forward the execution of all commands with a view to having the thirty vessels ready for 1925, when the "Imperialistic" French Navy will receive its first post-war increment of strength, altogether 65,000 tons, thus less than the aggregate displacement of the British *Rodney* and *Nelson*, less than the displacement of Italian post-war construction.

Compared with the British *Raleighs* (184 meters long, 20 wide, 5.20 deep), that are larger by 2,000 tons, the 8,000-ton *Duguay-Trouins* (175 meters, 17 and 5 respectively) are built on finer lines and their nominal horsepower is half again as large (100,000 h.p., against 70,000). Each French small-tube boiler is expected to produce 12,500 h.p., and it is hoped it will in service exceed 14,000 h.p. Also, the French *croiseurs légers* excel the United States *Omaha* in every respect. To account for their 800-ton advantage in displacement, they have 10,000 more horsepower, more powerful guns (the French 155mil. weapon outmatches the 6-inch type), and much better protected in 6-inch armored twin turrets with a much wider

field of training than that enjoyed by the American 6-inch battery. When every point is examined the Americans are seen to be beaten hollow by their French rivals; a duel between the *Omaha* and the *Duguay-Trouin* would be a foregone conclusion.

But in truth the new *croiseurs légers* are made to run rather than to fight. Special attention has been paid to their protection, and one of the arguments brought forward last year to decide the adoption of the 6.1-inch type in preference to 7.6-inch ordnance was that heavy calibers might give commanders temptations to stop and fight instead of bravely running away in pursuit of those strategic objects that are the main *raison d'être* of the French cruiser program. To this contention, however, the retort has been made that fight is the ultimate and unavoidable ending of any trial of strength, speed being somewhat unreliable, and that superior range was the best asset in a warship designed either to discourage pursuit or to bring to book an unwilling enemy. To such ideas Paris experts have given thought and do not share the late Lord Beresford's opinion as to the cruiser-destroyers *Glorious* and *Courageous* being "hare-brained ships."

The six *Jaguars* of 2,400 tons please everybody, though constructors will have to exercise every care to keep within the limits of the prescribed displacement. The battery of six 130mil. guns (a novel type in the Marine Francaise), distributed in five gun position, is of power and range unusual in destroyers, fully a match for pre-war 8-inch cannon. In reality these so-called *contre-torpilleurs* are destroyers of destroyers, a belated counterpart to the pre-war British *Arethusas* of 3,500 tons, which they surpass in all-round design; and the Italian Navy, though for the present better supplied than the French in destroyers, possesses no flotilla unit of equal speed and strength. All American destroyers are being rendered obsolete so far as artillery contests are concerned. The margin between scouts and destroyers is becoming thinner than ever. There are many French officers who oppose cruisers of 8,000-10,000 tons as being unnecessarily large and containing too many eggs in one basket. Instead, more robust *Jaguars* of 3,000 tons, made for high sea service, are being advocated to act in co-operation with aerial flotillas. Little would be needed to transform the French *contre-torpilleurs* into comfortable oceangoing boats.

The so-called *torpilleurs d'escandre* have seen their displacement raised by successive ameliorations to 1,455 tons (1,800 tons at full service load). They have points in common with the excellent British *Wolverines* of 1,400 tons and 28,000 h.p., and they will be equal to them in all-round robustness, perhaps superior. The lesson of the 900-ton series (*Bouclier-Roux*) has been taken to heart, and they make no show whatever this time. Experience has shown that there is no class in which there is more make-believe than in small destroyers. Trial speed is nothing to go by. The *Casque*, for instance, that did up to 37 knots under trial, has given no end of disappointment in practice. She is about the worst of her series, though reckoned on paper to be the best. The most successful of her sister ships is the *Capitaine-Mehl*, a St. Nazaire boat (Chantiers de la Loire), that maintained 30 knots under service conditions. A good reliable sea speed is what has been aimed at by the designers of the twelve *Bourrasques* of 1,455 tons that have been ordered at seven different firms, some of them with no previous experience in destroyer construction. These boats will compose the bulk of French flotillas, altogether thirty-six by 1930, which is relatively moderate. It is not intended to increase much the tonnage of these craft. Their armament of four 5.2-inch quick-firers is estimated to give them some advantage over all existing destroyers.

The six *Requins* submarines of 1,150-1,440 tons, 2,900 h.p., and 16 knots

thirty day cruising radius of action) are built primarily for robustness, reliability, and habitability, and to serve as torpedo-submarines. They will carry ten torpedo tubes and sixteen 22-inch torpedoes. Their 4-inch gun is intended mostly against seaplanes. Their freeboard, when in surface trim, will be greater than that of the *Chailley*, their buoyancy slightly exceeding twenty per cent, against twenty-five for the *Dupuy de Lôme*. The amazing fact is that a dozen different firms and arsenals take a share in the construction of these six boats.

The second-class submarines *(de petite patrouille)*, 600-765 tons, 1,200-1,300 h.p., and 14 knots, six in number, are of three different types, a fact that has given rise to severe criticisms. They, too, carry a 4-inch anti-aerial quickfirer, seven torpedo tubes, eight torpedoes. The surface motors will be of three different types: viz., Vickers, Sulzer, and Schneider, which makes these boats more or less experimental. Admiralty opinion is opposed to underwater craft of less than 1,200 tons. At the same time the question of cost and number has to be considered, especially for work in narrow seas. Great divergence of views prevails on these points.—J. B. Goutreau in *Naval and Military Record*, 11 April, 1923.

THE NEW FRENCH NAVY.—The first part of the French naval program, which covers the period until 1925, provides for the construction of three light cruisers, the transformation of the battleship *Béarn* into a seaplane carrier, six destroyers, twelve torpedo boats, six first-class and six second-class submarines. The cruisers of 8,000 tons displacement, known as the *Duguay-Trouin, La-Motte-Picquet* and *Primauguet*, will be 175.30m. long, 17.20m. in beam, and will draw 5.30m. of water. Eight small-tube generators fired with oil will supply steam to Parsons geared turbines, driving four shafts and developing a total of 100,000 horsepower. The speed is to be 34 knots. The armament will consist of eight 155mm. guns in eight double turrets, four anti-aircraft guns, and four 550mm. torpedo tubes. These cruisers will have no protection and everything is to be sacrificed to speed. The *Béarn* is one of the battleships under construction at the time of the outbreak of hostilities, and while the three uncompleted sister ships have been scrapped, she was too far advanced to share the same fate, and is to be converted into a seaplane carrier by the Forges et Chantiers de la Méditerranée. She has a length of 175m., a beam of 27.16m. and a draught of 7.86m., and is driven by two turbines and two reciprocating engines developing 35,000 horsepower. The twelve steam generators are fired with oil. The armament will consist of eight 155mm. guns, six anti-aircraft guns and six torpedo tubes.

Following the practice in the British Navy, the light craft are designated by names representing a class, the six destroyers being known as the *Jaguar, Panthère, Léopard, Lynx, Chacal* and *Tigre*. Having a displacement of 2400 tons, their length is 119.70m., and their width 11.08m. They will have two geared turbines of the Rateau or Breguet type developing 50,000 horsepower. Steam will be supplied by five oil-fired generators. The speed is expected to be 35.5 knots. They will be armed with six 130 mm. guns, two anti-aircraft guns and two triple torpedo tubes. The twelve torpedo boats will have meteorological names, such as *Orage, Tempête, Tornade*, and will have a length of 99.30m., and a beam of 9.64m., and be fitted with two geared turbines developing 30,000 horsepower. Steam will be raised in three generators with oil fuel. The speed will be 33 knots. The torpedo boats will have four 130mm. guns, one anti-aircraft gun and two triple torpedo tubes. The six first-class submarines are to be named the *Requin, Souffleur, Morse, Narval, Marsouin*, and *Dauphin*. Their displacement at the surface will be 1147 tons, and submerged 1438 tons. Their length is to be 78.25m., and beam 6.84m. For

navigating at the surface they are to carry two Diesel engines developing 2,900 horsepower, and for underwater propulsion two electric motors of 1,800 horsepower with a battery of 248 accumulators. The speed at the surface is to be 16 knots, and submerged 10 knots. Each submarine will carry a 10cm. gun and ten torpedoes in tubes and six in reserve. The six second-class submarines, named *Ondine, Ariadne, Naiade, Sirène, Circé, Calypso,* will be practically of the same type but smaller. Their surface speed is to be 14 knots, and underwater speed 9.5 knots. The displacement at the surface will be about 600 tons, and submerged from 50 to 775 tons. In the four submarines constructed by the Chantiers de la Loire and Schneider, the two Diesel engines of 1,200 to 1,300 horsepower will be of the two-cycle type, but the vessels built by the Chantiers Normand will have four-cycle engines. The electric motors will be of 1,000 horsepower. The length of the second-class submarines will vary from 62m. to 66m., and the width from 4.94m. to 5.40m. The vessels are being constructed to the builders' plans prepared according to specification. These submarines will carry one 10cm. gun and eight torpedoes.

The credits voted for this part of the program amount to 775 million francs. It is estimated that the light cruisers will cost eighty million francs each, the destroyers twenty-eight millions, the torpedo boats eighteen millions, the first-class submarines seventeen millions, and the second-class submarines ten millions. The work of construction is already well in hand, the cruisers in the arsenals, and most of the light craft in private shipyards, and it is expected that the whole will be completed early in 1925.—*The Engineer,* 20 April, 1923.

Doubts Concerning Design of New French Ships.—There is a certain amount of doubt in naval circles as to whether the French designers have not bitten off just a little more than they can chew in the new ships which are now being built. If they really do carry all the features which have been worked into their plans and still remain good seaboats and habitable, the Ministry of the Marine will certainly deserve all the praise that can be bestowed upon it by technical men, but one cannot help remembering that the Italians built a number of ships which were wonderful on paper but which were not sufficiently robust for real war work and which accordingly had to spend an unnecessary proportion of their time in harbor. In the case of the new French ships the doubts are present, particularly in the case of the flotilla leaders of the *Jaguar* type, which are to have a displacement of 2,400 tons. On this comparatively moderate size they are to combine a very high speed with a battery of six 13-centimeter guns (rather more than five inches) which are an entirely new pattern and which are said to be as effective as the pre-war 7.6-inch guns which the French mounted in their cruisers. That may or may not be so, there is not yet sufficient data published to tell, but one cannot help thinking that a ship of this type will be an exceedingly lively packet, especially for work in the English Channel or Atlantic. And one cannot help remembering that taken by and large, the French seaman is not a very big fellow, certainly not as big as his British or American opposite number, and trying to maintain any rate of fire with a man-handled gun of this size in any sort of a seaway will be impossible. We found that our *Arethusas* of about a thousand tons more displacement were rather too small for the work that is proposed for these *Jaguars.*—Capt. F. C. Bowen, Royal Marines in *Our Navy,* 1 May, 1923.

GERMANY

War Production of Submarines at Germania Yard.—At the beginning of the war the Germania yard had twelve submarines in varying

degrees of construction. When mobilization was proclaimed additional boats were at once contracted for by the naval authorities, and in order to minimize delay it was proposed to model them on the latest successful type then in hand: viz., the *U-41*, a boat of 684 tons. But as war experience soon indicated the desirability of certain departures from previous practice, the war-built boats differed in several respects from earlier types, and these differences became more marked as the campaign progressed. A few of the leading modifications may be briefly noted. It was found that the time usually occupied in flooding tanks for diving: viz., about five minutes, was far too long, rapid submergence being of paramount importance in war operations. This necessitated larger flooding valves and a more powerful system of air expulsion. A demand was also raised for a stronger torpedo and gun armament, while, the cruising endurance of the boats was increased by utilizing some of the diving tanks as reserve bunkers for oil fuel. Although the power of the surface machinery was augmented, that of the electrical plant for submerged cruising remained practically constant, even in boats of larger dimensions, with the result that underwater speed declined from 10.1 knots to 8.5 knots. It is stated, however, that this circumstance in no way prejudiced the military effectiveness of the boats. The lines of the hull were modified to give better sea-keeping qualities; the upper deck was kept at full breadth almost from end to end; the straight cutwater gave place to a clipper bow; the conning tower was raised and a permanent weather screen fitted to the bridge. Consequently, a *U*-boat of 1918 differed greatly in appearance from one of 1914, though internally both were very similar. Several special types were evolved during the war, notably the *UB* class, a small torpedo vessel designed to operate from the bases in Flanders; and the small *UC* mine-layers, which were eventually enlarged and fitted with torpedo tubes and gun armament. At the Germania yard, too, were built the commercial submarines referred to above, and the same establishment undertook the reconstruction of these boats when their original purpose had been frustrated by the entry of America into the war.

Of the first submersible cruisers proper: viz., *U 139* and *141*—see Supplement—and *U 142-144*, the details set out in the table in the next column are given.

While the conversion of the *Deutschland* class into so-called "*U*-cruisers" was only an emergency measure, undertaken for the purpose of making them available for war purposes, the *U 139-144* class were designed from the beginning as cruisers—that is, as boats which, by virtue of their dimensions, radius, armament, speed, and other qualities would be capable of operating against enemy merchantmen and warships in waters remote from their base. The requisite endurance was easily attainable by the use of Diesel engines, but very high surface speed could not be achieved without a prohibitive increase in dimensions, nor was it feasible to endow them with a good speed below water. On the other hand, the range and power of their artillery compensated to some extent for lack of above-water velocity, while the low speed when submerged was of minor importance in view of the fact that the gun, not the torpedo, was the principal weapon of offense in this type. It was found possible to give these cruisers a limited amount of armor defense. The conning tower had a protective screen of 2.36-in. armor, placed far enough from the tower to ensure that damage to the screen would not affect that structure. The pressure hull was built of stouter plates than were necessitated by the diving depth, and the plates were made of specially strong material. Furthermore the hatches leading to the interior were fitted with double crowns, and above the torpedo tubes and steering gear there was protective

Particulars of U 139, 141, 142, 143, 144.	*U 139-141*	*U 142-144*
Length overall, feet	301ft. 10in.	319ft. 10in.
Maximum breadth, feet	29ft. 6in.	29ft. 7in.
Diameter of pressure hull, feet	18ft. 9in.	18ft. 9in.
Displacement on surface, cubic meters	1930	2138
Displacement submerged, cubic meters	2484	2800
Engine power on surface, feet	2 x 1750	2 x 3000
Speed on surface, knots (estimated)	15.8	17.75
Maximum oil storage, cubic meters	464	557
Radius at 10 knots, in knots	20,000	18,000
Engine power submerged, horsepower	2 x 900	2 x 1300
Speed submerged, in knots	7.6	8.25
Diving depth, in feet	246	246
Number of torpedo tubes	6	6
Number of torepodes carried	19 of 19.7in.	19 of 19.7in.

deck plating. So defended, they were less exposed to fatal injury by gunfire than the ordinary type of submarine. The torpedo armament consisted of four bow and two stern tubes. The majority of these cruisers were fitted with two sets of M.A.M. 1750 horsepower four-cycle motors; but one of them had two sets of Germania 1,650 horsepower two-cycle engines. All the engines had six working cylinders. For the later *U*-cruisers two ten-cylinder engines, each developing 3,000 horsepower, were built. Only one charging engine was provided, and this could also be used for low-speed cruising in an emergency. As the space did not permit of storing enough drinking water for a voyage of several months' duration, a distilling apparatus was fitted, heated by the gases from the exhaust. The only cruisers that saw any war service were *U 139* and *140*, and then for a short period only. Both, it is claimed, proved thoroughly efficient in technical and military qualities. Of the other cruisers, *U 141* was commissioned just before the Armistice; *U 142*, the first boat with the heavier engines, had completed its trials; and *U 143* and *U 144* had been launched. Four pressure hulls of unfinished submersible cruisers were afterwards utilized in the construction of the oil tankers *Ostpreussen* and *Oberschlesien*, built for the Stinnes firm.

Finally, Dr. Techel reviews the output of submarines by the Germania yard from 1902 down to the Armistice. Within this period it delivered 101 boats with a total displacement of *circa* 76,500 tons propelled by engines of 159,000 horsepower in the aggregate. A further thirty-five boats of 52,000 tons and 124,300 horsepower were fitting out or building, and forty-seven more, totalling 47,000 tons, were on order. A very brief reference to the war exploits of Germania-built submarines brings to a conclusion one of the most informative and interesting technical volumes which has been published in Germany since the peace.—*The Engineer*, 13 April, 1923.

JAPAN

More Data on Naval Expansion in Japan.—London, May 3.—British naval circles are interested in the news that the Washington Cabinet is busy mapping out a definite policy of preparedness by sea, based upon the new strategic situation created by the five-power limitation treaty, and having as its aim the maintenance of American parity not in battleships alone but in all the various types of fighting craft which go to make up a well-balanced fleet. Here it is regarded as certain that the discussions now reported as taking place between President Harding, his Cabinet officers and naval and military advisers will eventuate in a shipbuilding program to be laid down before Congress in December.

Only those intimately in touch with American public opinion are able to say what the fate of such a program is likely to be. One gathers, however, that it will meet with opposition from a strong element in the next Congress which is averse to armament expansion in any form, from motives of idealism, even more than for reason of economy. On the other hand, it is clear to every naval student that the United States must either augment her fleet without delay or rest content with a ratio of strength considerably less than that which the treaty assigns her.

Observers on this side are learning to take a philosophical view of the strange comments on British naval policy which sometimes occur in American news dispatches that seem to bear the stamp of departmental inspiration. They no longer feel astonished or indignant on reading such statements as that "Britain and Japan are both building strongly in the direction of auxiliary ships." The belief now prevails that Britain is coupled with Japan in this way purely for diplomatic reasons, and not because the American naval chiefs see anything disturbing in British naval preparations. To cite Japan, and Japan only, as the power whose shipbuilding activity threatens to overturn the scale of relative strength established by the treaty would be indiscreet, and might lay the naval authorities open to the charge of running a propaganda inimical to friendly relations with that power. It is therefore deemed prudent to talk of Japanese and British shipbuilding activity, though none know better than American experts how very small the British program of construction is.

For similar reasons, when proposing that the elevation of turret guns in American battleships should be increased to give them higher ranging power, the Navy Department rested its case mainly on the alleged superiority of the British fleet in this respect, next to nothing being said about the Japanese fleet, despite the fact that Japan was actually engaged in enlarging the elevation of her guns, while Britain was not. And so the conclusion has been reached that whenever the Navy Department urges the necessity of taking steps to counterbalance the naval superiority of Britain and Japan, it is thinking primarily of the latter.

This is surely not an unreasonable inference, in view of the fact that Japan alone is forcing the pace in auxiliary construction and building at least six times as much tonnage as Britain.

I have lately secured what purports to be an authorative résumé of Japanese naval policy since the Washington conference, with particular reference to shipbuilding. It is of Japanese origin, and the data do not entirely correspond with those from other sources, though in no case is the discrepancy very serious. The opening passages may be quoted verbatim:

"Since no one has accused Japan of transgressing the letter of the limitation treaty, it is only necessary to explain and justify the program of light construction which has given rise to so much criticism and misunderstanding abroad. As has been categorically stated by the Imperial Government more than once, this program is in no sense a new measure. It is simply an amended version of the auxiliary program that was passed by the Diet in 1920 as an integral part of the so-called 'eight-eight' scheme. So far as it concerned big ships, that scheme was practically abolished by the limitation treaty. Of the sixteen capital ships it legislated for all save two (*Nagato, Mutsu*) have been scrapped or canceled.

"But since the treaty did not affect small ships, Japan felt herself at liberty to carry out, in an abbreviated form, the original program of light tonnage, the more so as all the other powers continued to build these smaller naval types, or had expressed their intention of doing so. What we are now doing, therefore, is to proceed with the building of such cruisers, torpedo craft, submarines and gunboats as the Ministry of

Marines judged to be absolutely essential to the defense of the empire. But so far from having adde to the original light program, we have actually reduced it by 13,000 tons. Otherwise it has only been modified to the extent of building certain units to increased dimensions (for example, some cruisers have been enlarged from 5,600 tons to 7,000 or 10,000 tons, and a few submarines at first intended to be medium boats have been redesigned on ocean-going principles), and curtailing by one year the completion date of all vessels, which means that the program will have matured by 1927 instead of 1928.

"It is often assumed that these light craft are peculiarly adapted to offensive operations and are being built with that object. But there is no real ground for this assumption. As regards cruisers, Japan has a large and thriving sea trade, which in case of war would need to be protected, and to this work the fast light cruiser is admirably suited. Other countries, notably the United States and England, possess many similar ships, but no one accuses them of meditating a raid on the shipping of another state. The destroyer is essentially a defensive type, especially in the hands of a power like Japan, which is so remote from any possible future enemy. These boats have a very limited steaming radius, which keeps them tied to their own coast or battle fleet and they could not be well used for attacking commerce.

"This leaves only the submarine, regarding which the English Admiral Ballard wrote not long ago: 'It is an open question whether the greater part of the money that Japan is spending on other ships would not be better invested in the form of submarines, for Japanese waters are particularly well suited to the operations of that type of vessel on account of their great depth, which precludes the possibility of submarines being "mined in" as they were in the North Sea. With a couple of hundred of these craft as a defense no foreign battle squadron would ever be likely to approach her coasts or attempt to enter the Yellow Sea.' This confirms the accuracy of Baron Kato's judgment when he insisted at Washington that cruisers and submarines should be rated as defensive ships.

"Finally it should be borne in mind that Japan is totally dependent on sea communications for her very life. Without an adequate navy she could be easily subdued, either by blockade or direct attack. It was for this reason that she decided, after agreeing to scrap the best part of her battleship fleet, to build a moderate number of other types whose war value had been automatically increased by the disappearance of so many dreadnaughts. Japan is building against no one, but simply and solely to cover her minimum requirements for defense; nor will her present program be enlarged unless some drastic change takes place in the scale of relative strength now existing."

This last sentence is rather obscure, but presumably it means that if any other power laid down a considerable number of new auxiliary ships Japan would make a corresponding addition to her own program.

Turning now to the figures appended to this statement, showing the progress of Japanese construction in recent years, they are found to confirm all that has appeared in this correspondence relative to the rapid development of the light cruiser fleet:

Light criusers completed since 1918	12
Light cruisers now building	7
Light cruisers authorized but not yet begun	6
Total	25

The position of the British and American navies in regard to the same type of ship is as follows:

	Great Britain.	U. S. A.
Completed since 1918	11	1
Now building	5	9
Authorized but not begun	0	0

All but one of the British ships were commenced during the war, while the ten American ships and twenty-three of the Japanese were laid down subsequently to the armistice.

With regard to Japanese destroyers, the statement says: "Between now and 1927 only twenty-four boats are to be built. They will be slightly larger than the American flush-deckers. Including these boats the Japanese Navy has less than 100 modern destroyers, whereas the United States has 300 and England about 150."

The position as to submarines is explained less clearly. Japan, it is claimed, has been building at the rate of six boats per year since 1918, and twenty-four boats of the revised auxiliary program remain to be laid down. But it rather significant that whereas the official building returns show Submarine No. 56 to be the latest boat under construction, the Japanese press reports an explosion as having occurred on March 15 inside Submarine No. 75, building at the Kobe Mitsubishi Yard. The fact is that submarines bearing numerals running well into the eighties are positively known to be constructing in the Japanese yards.—Hector C. Bywater, in *Baltimore Sun*, 15 May, 1923.

Personnel and Matériel.—Replying to questions in the Diet, Admiral Kato, the Prime Minister—who still retains the portfolio of the Navy—imparted some new facts with regard to the personnel and matériel of the Japanese Navy. Although the "eight-eight" scheme had been abandoned, there was no intention, he said, of dismissing any of the younger officers of the service, though if any of them did see fit to leave the Navy they would be assisted to find employment in the merchant service. Admiral Kato gave the following figures of personnel reduction in the three leading Navies since the Conference:—United States, "more than 20,000"; Great Britain, 20,000; Japan, 12,000. One member inquired how many vessels of the Fleet were equipped with anti-aircraft defenses, to which Admiral Kato replied: "Only one or two," adding that "new vessels would be provided with such equipment." Whether "anti-aircraft" defenses in this case meant high-angle guns or deck protection, or both, was not made clear. The standard A. A. armament for all capital ships of the first line is four 3-inch 13 prs. New light cruisers mount one or two 3-inch A. A. guns, but the older ships of all types are apparently without any special guns for use against aircraft.

The Paris *Temps* states that several Japanese submarines now building, including No. 72, have a surface displacement of 2,000 tons, a radius of 16,000 miles, and an armament of two guns, sixteen torpedoes, and mine-laying gear. Including No. 72, six boats of this class are now on the stocks.—*Naval and Military Record*, 11 April, 1923.

UNITED STATES

U. S. Begins Task of Scrapping Navy.—The United States already has embarked upon the scrapping of the first-class battleships which are to be dropped from the fleet under provisions of the Washington Arms Conference treaty, according to an informal survey made by navy officers.

Although it was definitely announced that no action looking to the

obliteration of these ships would be taken until ratification of the treaty had been completed by the signatory powers, at least eight of the thirteen dreadnaughts slated for the scrap heap by the United States are said to be in such condition that from fifteen to twenty months of steady work would be required to fit them again for sea duty.

"Scrapping" activities on the part of the navy have been confined to the removal of equipment for use in other vessels or in shore establishments, but officers declare the result has been to destroy the effectiveness of the ships over a long period of time as certainly as though they had been junked.

The *New Jersey* and *Virginia*, lying at the Boston Navy Yard, have been "stripped very thoroughly" according to the report, the equipment having been removed for use in the repair of other naval vessels. The submarine tender *Canopus*, in particular, now carries important items of machinery and fittings salvaged from the two battleships.

At the Philadelphia Yard the same program has been followed in dealing with the *Kansas*, *Louisiana*, *Minnesota* and *New Hampshire*. The main generating set from the *Michigan* is now driving the aircraft carrier *Langley*, and other auxiliaries, which naval experts assert would require at least a year to replace, have been removed from battleships and installed in other vessels.

The four battleships at Mare Island, according to latest advices, have fared somewhat better. The *Vermont*, *Georgia* and *Rhode Island* have lost important gear, but in case of emergency it is believed these ships could be placed in commission in a few weeks, while the *Nebraska* has been practically untouched except for routine "battening" to prevent deterioration.

The *Connecticut*, recently docked at Puget Sound preparatory to dismantling, has to date lost only some of her lighting equipment.

Entirely apart from the status of the thirteen ships as potential fighting units, navy officials view with concern the financial cost which has attended the delay in formal execution of the treaty. Expenses resulting from carrying the thirteen ships are estimated conservatively at $1,000,000 a month, in addition to the claims that were filed by contractors for work discontinued under the treaty now on seven battleships and four battle-cruisers.

Shortly after the conference, Government actuaries declared cancellation of contracts, adjusted compensation for preliminary work and other intangible expenses on the suspended program would reach a total of $60,000,000 to $70,000,000. The total has grown, it was said, storage of material and cost of berthing space where the ships were under construction in private yards alone having amounted to large figures.—*Baltimore Sun*, 8 May, 1923.

"Well-Defined Weaknesses" of Panama Canal.—It is disquieting to read a long list of "Well-defined weaknesses" in the defenses of our great canal, which Admiral Jones reports to have been demonstrated by the joint maneuvers off Panama. Among these are several that relate purely to the local defenses; susceptibility of certain vital parts of the canal to damage from air craft bombs; faulty grouping of shore artillery resulting in exposure of the Miraflores locks to bombardment from the sea; an insufficiency of aircraft attached to the canal defense, etc.

These weaknesses may necessitate the diversion of the fleet to the limited objective of giving local defense to the canal; a most unfortunate disposition of naval power which would defeat the very purposes for which the fleet exists.

The importance of the canal is derived from the fact that it permits

ready communication between our Atlantic and Pacific seaboards. With the fleet concentrated for a local defense of the canal itself, manifestly the water communications from the United States to the canal would be open to easy interruption by hostile forces, and as valueless as though there were no canal.

The fleet's task is to safeguard the communications as a whole, and not merely one link in the line, no matter how vital that link may be. Each important shore link must have its own local defense sufficiently strong to free the fleet from being tied to that restricted locality.

It is interesting to note Admiral Jones's opinion that, in addition to certain more strictly military local defense measures needed at Panama, there should be established a system of aircraft bases "at points within striking distance of the canal." This would amount to a great expansion of the local defense zone which would still further free the fleet.

In addition to the defensive benefits incident to direct attack against the enemy by outlying aircraft, such a system would be a source of information of immense value to the military forces and to the fleet also; probably enabling the latter, while operating from an advanced point, to intercept any attacking forces.

Under these conditions the fleet can base at a distant point without impairing its ability to afford due protection to the canal; an advantage of no mean importance when we consider that in order to cover the whole line of coastal communications the fleet, while operating on the strategic defensive, must occupy a position well advanced on the flank of such communications.

Admiral Jones makes no mention of the need of main fleet bases at outlying places in the Caribbean and the Pacific to serve as a flank protection to our great coastal communication system, of which the canal is a pivotal point.

Doubtless this omission is due to the question's being only incidentally related to canal defenses. But that consideration has been given to this aspect of the matter is indicated by the visit of the *Henderson*, carrying the Congressional party, to various insular harbors in the Caribbean as far east as St. Thomas.

From a strategic viewpoint, our naval position in the Atlantic is peculiarly weak from having no suitable major advanced base for our fleet. Reduced to the simplest terms, our need is for the proper equipment and fortification of the most salient point which will satisfy the tactical requirements. Our only present base, Guantanamo, is deficient on both counts, it is too far west, and too small to contain the whole fleet. Moreover, it is difficult to defend. Samana Bay fulfils all tactical requirements, but is not sufficiently advanced. The region St. Thomas Eastern Porto Rico best meets all the basic conditions and should undoubtedly be developed.

Heretofore the difficulty in any such projects has been the unwillingness of Congress to appropriate considerable sums of money for expenditure in localities where there are no votes, especially when the Congressmen do not understand the broad underlying needs therefor. Let us hope that the recent trip on the *Henderson* will correct at least the latter condition.

In the Pacific we have an imperfectly developed outlying base at Oahu. It imperatively needs extensive improvement, and when this is done will serve as excellent protection to our whole coastwise communications in the west. Hawaii is so far distant from Panama, however, that a close auxiliary position should be added to the system of outlying bases.

The Gallapagos Islands offer the only practicable place for this, but unfortunately they do not belong to the United States. Their foreign ownership introduces an element of danger to the Pacific approaches to

the canal. If possible, we should acquire these islands and establish a naval base there.—*Army and Navy Journal*, 21 April, 1923.

FLEET MANEUVERS FOR NEXT WINTER.—Secretary of the Navy Edwin Denby announces that the fleet maneuvers next winter will be held in the Carribbean, and that the United States Fleet will have as its base that portion of the Vieques Sound in the vicinity of Culebra Island.

The Scouting Fleet will probably proceed to Culebra early in January and the Battle Fleet should reach there in February, after passing through the Panama Canal. Most of the time the fleets are together will be spent in battle maneuvers and exercises, tactical maneuvers predominating. A war game will be held at some point in the Caribbean. Several thousand of the Marines now stationed at Quantico will be landed on Culebra Island for some weeks during the winter and will take part in some of the general maneuvers.

In view of the length of time that will be spent at Culebra, the Department proposes in the middle of the stay to have visits made by divisions and individual vessels, battleships, destroyers, submarines, aircraft and train to West Indian and Gulf ports with the possibility of having the Pacific Coast ships visit our own Gulf ports. In the West Indies such ports as Havana, San Juan, St. Thomas, Barbado, Port of Spain and other places of importance will be visited.—*News Bulletin*, 12 May, 1923.

AMERICAN NAVAL STRATEGY.—After combined maneuvers lasting six weeks, the squadrons and flotillas comprising the newly-organized "United States Fleet" dispersed on March 31, some to Pacific and others to Atlantic waters. The exercises, which were held for the most part in the Bay of Panama, included battle practice by the Dreadnaught squadrons, submarine and aerial operations, and an assault on the defenses of the Panama Canal. This was probably the first time that all the commissioned ships of the United States Navy—excepting those on foreign stations—had been grouped under one command for so long a period, and it is safe to assume that the efficiency of the active fleet has been considerably improved by this lengthy spell of training "in team." The fact that the designation of "United States Fleet" has been officially adopted is not without significance. It implies that the strategic unity of the fleet has been restored; that, although some squadrons may, for the purposes of convenience, be stationed in the Atlantic and others on the West Coast, strategically the fleet is to be regarded as one and indivisible, and effect will be given to this principle by combining all formations from time to time and carrying out evolutions and maneuvers similar to those which ended last month. It is evidently not the intention of the Washington authorities to keep the entire commissioned fleet in the Pacific, though reports of such a decision were current in the American Press not long since. For the time being, therefore, a number of squadrons will continue to be based on Atlantic ports, which are better equipped for the repair and maintenance of modern vessels. As the Naval Secretary pointed out in his latest annual report, the existing system of bases and dockyards was developed mainly with an eye to the employment of the fleet in the Atlantic and the Caribbean, and is therefore inadequate to cope with the requirements of a large force permanently stationed in the Pacific. This dearth of well-found navy yards on the West coast is, no doubt, largely responsible for the retention of certain squadrons in the East, as most American strategists agree that the whole battle fleet ought, if possible, to cruise and train in the Pacific Ocean.

On several occasions during the past few years detailed proposals have been made for the enlargement of Pacific bases already available and the

creation of new ones in that ocean, but for reasons of economy little has been done in this direction as yet. The board of inspection which investigated the matter in 1919 found that the joint resources of Mare Island and Bremerton Navy Yards were quite incapable of attending to the needs of the then Pacific Fleet, and recommended the immediate development of Bremerton Yard on a large scale. Until this work was completed, the Board added, the new Pacific Fleet as a whole could not be kept in good condition and repair on its own station. Since then the fleet in question has been augmented by several of the heaviest battleships afloat, and the problem of maintenance has therefore become intensified. In this respect Congress is very like our own Parliament; it would rather spend money on ships than on docks, which make no appeal to the imagination, though as an essential factor in war preparedness they are every whit as necessary as Dreadnaughts. American officers do not disguise their concern as to the inadequacy of dockyard accommodation in the Pacific. Realizing that such establishments cannot be improvised in an emergency, they pertinently ask what the fleet would do if it had to wage war in an area practically devoid of well-found bases. Damaged or defective ships which could not be dealt with by the Pacific yards would have to be sent to Atlantic ports, 5,000 miles away, a voyage that would be no light undertaking for a seriously injured vessel. So far as can be gathered, there are now under American control in the Pacific six docks capable of taking the largest ships: viz., two at Bremerton, one at Mare Island, two (private) at San Francisco, and one at Pearl Harbor, Hawaii. While this number may suffice for peace requirements, it would be altogether inadequate in war.

Since it is generally agreed that if, in the years ahead, the American Fleet has to fight at all, it will fight somewhere to the west of Hawaii, the resources of that island base are naturally scanned with interest by those who seek to weigh the chances of warfare in the Pacific. Pearl Harbor has at present but one dry dock of Dreadnaught dimensions. The board of inspection referred to above urged that the station be expanded into a first-class fleet and submarine base, with several more docks, additional repair plant, and reserves of fuel and stores for the entire Pacific Fleet and its auxiliaries, but this scheme has not yet been carried out. A fleet in action west of Hawaii would, therefore, have only one dock within reasonably easy reach. There are others at San Francisco, but that port is 2,100 miles distant. Thus, the American Fleet would be badly handicapped by lack of base accommodation even if it were fighting a more or less defensive campaign. As for carrying the war into the Western Pacific, that would seem to be physically impossible in view of the absence of any major base in or adjacent to Asiatic waters. The present organization of the "United States Fleet"—nominally a united force, but actually divided between the two oceans—pivots, of course, on the Panama Canal, which offers a short cut for ships proceeding from one ocean to the other, the idea being that a fleet in either ocean could be reinforced in a comparatively short time if the situation became critical. But, although the voyage from New York to San Francisco is only 5,265 miles by the Canal, as compared with 13,275 miles round the Horn the two sections of the fleet are still widely separated. And if, at a critical moment, the Canal were blocked by accident or design the ships in the Pacific would have to bear the whole brunt of the campaign in its early stages. —*Naval and Military Record*, 25 April, 1923.

MERCHANT MARINE

MERCHANT MARINE OUTSTANDING NEED.—I made allusion in the beginning to political charts and the good faith of political parties. Sometimes there must be a variation from the charted course, because of the unexpected development of impassable shoals. This Administration, pledged by a sponsoring party for a quarter of a century to the building up of a merchant marine, was unable to secure the enactment which was believed to be the way to fulfilment. But it would be a small Administration which would surrender the aspirations for an American merchant marine and scrap or sacrifice our great merchant fleet in a pique of disappointment over the Senate's failure to give approval.

For security of defense, for the avoidance of a like extravagant and ineffectual outlay in case of future war, for the promotion of our commerce and our eminence on the seas, I believe a great merchant marine to be an outstanding American requirement. Since we cannot hope for Government aid to private ownership, we propose to do our best to organize and consolidate our lines and service, applying the lessons of experience which cost us hundreds of millions in operations alone, then offer for sale. If we cannot sell, we will operate, and operate aggressively, until Congress inhibits. Confessedly, this is a contradiction of the proposal to have less government in business and more business in government, but if we cannot get out of the shipping business in a practical way and be assured of privately owned and privately operated shipping, it is the business of the Government to conserve our shipping assets and make for our self-reliance on the high seas.—Abstract from Address by President Harding to *Associated Press*, New York, 24 April, 1923.

INVITES BIDS ON SHIPS.—Washington, April 28—Bids for purchase of all passenger and cargo ships on its register on a basis of guaranteed operation for a period of years over prescribed routes have been invited by the Shipping Board in its final effort to convey the Government fleet to private ownership and operation. In announcing the invitation for bids returnable May 28, the Board gave a list of eighteen routes into which the existing routes have been consolidated as those which will be given first consideration in the sale of ships. The Board it was said, is willing to consider proposals for other routes to be maintained under the same guaranty. Retention of ships on routes on which they are now operating is desired, although the Board will permit transfers and selections from the laid up fleet.

A basic condition is that each offer must carry with it a guaranty to maintain one of the present government routes or some new route acceptable to the Board.

The re-grouping, decided upon both as a measure of economy and to give operators a wider latitude in accepting freight, will cut the government routes to the following:

1—North Atlantic, United Kingdom (Great Britain and Ireland).
2—Gulf and South Atlantic, United Kingdom (Great Britain and Ireland).
3—North Atlantic, Continental Europe, north of Bordeaux.
4—Gulf and South Atlantic, Continental Europe, north of Bordeaux.
5—North Atlantic, Continental Europe, south of Bordeaux, including all Mediterranean and Black Sea.
6—Gulf and South Atlantic, Continental Europe, south of Bordeaux, including all Mediterranean and Black Sea.
7—Atlantic Coast and Gulf, East Coast South America.
8—Atlantic Coast and Gulf, Orient and Philippines.
9—Atlantic Coast and Gulf, India and Dutch East Indies.

10—Atlantic Coast and Gulf, Australia.
11—Atlantic Coast and Gulf, South and East Africa.
12—Atlantic Coast and Gulf, West Africa.
13—Pacific Coast, East Coast South America.
14—Pacific Coast, West Coast South America.
15—North Pacific, Orient and Philippines.
16—South Pacific, Orient and Philippines.
17—Pacific Coast, Europe.
18—Pacific Coast, Australia.

The bidders will be asked to specify by May 28, the ships he desires to purchase, the route he prefers to maintain, to set forth in detail his ability for guaranteeing adequate service and finally to give the "charter, frequency and extent of service."—*Boston Evening Transcript*, 28 April, 1923.

PRESS COMMENT ON MERCHANT MARINE.—"Don't Give Up the Ship!" These last words of the *Chesapeake's* dying captain are the most famous in American naval annals. Hardly less memorable is Commodore Perry's "We have met the enemy and they are ours." There is an echo of both cries in the conclusion reached by the President and stated by Chairman Lasker of the Shipping Board that if private owners will not buy our Shipping Board fleet, now that Congress has denied a subsidy, then the Government will go ahead and operate its ships aggressively on a larger scale—"the main thing is to maintain the flag on the seas." Here, as several editors note, is a strong reaction from the tone of dejection in President Harding's announcement to the last Congress that if it would not grant a subsidy, the Shipping Board's losses would have to be ended "in liquidation and humiliation." The new shipping plan, think such pro-Administration dailies as the Washington *Post* (Ind.) and the Pittsburgh *Chronicle-Telegraph* (Rep.), will be heartily approved by the people. Others, like the Philadelphia *Inquirer* (Rep.), Washington *Star* (Ind.) and New York *Evening Mail* (Ind.), warm to the defiant decision to keep our flag on the high seas, despite dangers and deficits. The new plans "imply a new hope for American shipping," thinks the New York *Times* (Dem.). At any rate, conclude the Springfield *Republican* and the New York *Evening Post*, (Ind.), it is about the only course left to pursue. And the New York *Globe* (Ind.), noticing how the President and his aides declare themselves driven to the new policy in spite of their fundamental objection to the Government in business, reflects hopefully that "it may turn out that for the first time in recent history an example will be given of the potentiality of public service when the zeal of men at the top is aroused." On the other hand, news writers picture shipping men "in anguish over Lasker's plan." which such mirrors of business thought as *The Wall Street Journal* and the New York *Journal of Commerce* remind the courageous Mr. Lasker of the fundamental soundness of the old adage, "Discretion is the better part of valor."

Readers may recall—for the figures are frequently quoted in the public prints—that the Shipping Board owns 1,400 steel ships of about ten million dead-weight tons. Some 400 of these ships are in service under allocation or charter, while 875 are now lying idle. The Shipping Board's present losses are said to run to about $4,000,000 a month—to be precise, $16,150,137 was lost in the four months ending March 1. There are said to be only thirty-two privately owned American ships engaged in foreign trade. Congress will pay no subsidy, but seems to be willing to make up the annual $50,000,000 shortage. If Uncle Sam's steel merchant fleet, which cost him roughly $3,500,000,000, can be sold at all, he will only realize a few cents on the dollar, while a large part of the fleet,

perhaps a third, must be scrapped and sold for junk. "So," reflects the Philadelphia *Public Ledger*, "will end the greatest opportunity of a century for America to resume her place on the sea."

That was what President Harding meant when he told Congress that if it failed to provide the requested subsidy, "the executive branch of the Government may proceed as best it can to end the losses in liquidation and humiliation." But the Shipping Board apparently was not ready to give up the ships without a fight. Chairman Lasker conferred with the President. There were rumors that a sensational policy would be adopted. The Shipping Board appointed committees and asked various groups interested in marine affairs to give advice. "Scrap," was a favorite word of the counselors. One body suggested that half of the Government's fleet be junked as defective, out of date and unserviceable. Another association thought the Shipping Board should sell all the ships anybody would buy and hand the rest over to the junk-man. Most of the advisers opposed government operation vigorously. Several suggested that, even without a subsidy, some aid and encouragement could be given to the American merchant marine by the Government.

After listening to much advice like this President Harding and Chairman Lasker announced a program of their own on April 14. The announcement, according to the New York *American's* Washington correspondent, "was regarded everywhere as a note of defiance that unless private capital wishes to maintain the merchant marine, the Government will enter into aggressive competition with the private lines. It was likewise an announcement to the world that the American flag is coming back into its own on the high seas." First came the White House declaration that the President and the Shipping Board were thoroughly agreed "that the chief end to be sought is the establishment and maintenance of an American merchant marine." So the Board has decided to "proceed at once to the consolidation of foreign trade lines and then offer the sale of these lines and ships under the authorization of the law, conditioned on suitable guaranty of maintained service." But:

"If such sales can not be made without justifiable sacrifice of the ships, then the Government will proceed to direct government operation aggressively pursued. In short, there is unanimous agreement that the existing law contemplates and authorizes an adequate and maintained American merchant marine, and such a course will be followed as will fully guarantee and contemplate its larger development."

The Administration will ask no subsidy aid from the next Congress, according to Chairman Lasker of the Shipping Board, but "will give direct government operation a thorough trial, once we adopt it as a policy." Mr. Lasker goes on to tell the newspaper men a little more about the Shipping Board program. The Board has already cut down the number of companies operating routes with government ships from eighty to thirty-nine, and will consolidate them still further to the number of about eighteen, all routes to be in the hands of experienced operators who are considered the most likely potential buyers. Then these routes will be offered for sale, probably within the next few weeks. "If," says Mr. Lasker, as the New York *Journal of Commerce* quotes him, "we can not get bids for practically all of them, we will not sell a few, because we would not want to sell two or three cream routes and let the Government 'hold the bag' for the rest." The President and the Shipping Board are strongly opposed to government operation. Mr. Lasker hates and despises it, but "the main thing to be considered is to keep the flag on the seas." The willingness of the private operators to buy will decide "whether the ships will be operated by private owners or by government operation."

Mr. Lasker thinks expenses can be cut and better service furnished than at present. He says further:

"What we are going to do with the ships not in operation, we do not know, but we want to keep enough on hand, if the Government operates the ships, to serve as a notice to the world that the American Government is ready to serve the trade throughout the world and that we have the ships to do it.

"We believe that if the Government goes into the operation on a large scale, and develops a large business for the routes that it will be the means of eventually selling the ships to private owners. We believe that when the foreign lines see that the Government is in the business to stay they will not try to break down the American lines and the private operators will then buy.

"We will sell any ships not in operation to any American citizen who wants them at the world market price. Any ships that can not be sold or that can not be operated profitably will be scrapped."

The Shipping Board, Mr. Lasker explains, "does not intend to take over the passenger lines for direct operation. This is a specialized business, and the lines that are now operating them have built up specialized organizations to handle it." Thus, notes the New York *Journal of Commerce*, "the services of the Munson Line to South America, the Pacific Mail Line to the Far East, the Admiral Line to the Orient, the Swayne and Hoyt service from the Pacific to South America, and the Los Angeles Steamship Companies line to Honolulu, will not be affected" by the scrapping of the existing contracts. Another member of the Shipping Board has stated that the United States Lines operating between New York and Europe will not be sold, but will be kept until it has been provided with a balanced fleet. The United States Line, says a third member, "is equal to any under any flag and the reconditioning of the *Leviathan*, the *Agamemnon*, *Mount Vernon*, and *President Buchanan*, which are to be placed in active service, will make us second to none in the strategic North Atlantic."

But what will Congress say about this new plan? The New York *World* quotes Senator Fletcher (Dem., Fla.), of the Senate Commerce Committee, as predicting that Congress will stand behind the new policy, and *The World* writer thinks that it will also please "the La Follette and progressive group in the Senate in favor of government ownership." In Senator Fletcher's opinion, as *The World* quotes him:

"It looks as if permanent operation of the fleet by the Government is inevitable. They can't get a subsidy and they can't sell, so there is nothing else left. The Government should go about it in a businesslike way. The lines now operated by the Government are the Panama Lines and the United States Line and both are successful.

"The Government can operate the Shipping Board vessels, keep down rates, protect us against high foreign rates, and more than break even."

But shipowners, writes Mr. William Hard in the New York *Globe*, are uttering cries of anguish as they realize that the Government can send out its ships and compete "the private ships into destitution." One view in shipping circles is that here is "the supreme salesmanship device of that reputed supersalesman, Albert Lasker," "the fightingest sales campaign that Lasker ever organized." As the shipowners see it:

"We have refused to buy his ships at his price. Very well. Now he takes his ships and starts them out against us until . . . we get poorer and poorer in operating our own private ships against Lasker's ships; and in the end we will have to put on our hats and go to Lasker's office and say: 'Please, sir, please, will you let us have your ships at any price that you think is right.'"

There is a plain inference in the shipping Board's announcement, remarks *The Journal of Commerce*, "that vessel operators may choose between buying the ships on the Government's own terms or see their business cut to pieces, as they may choose." In other words:

"It is a case of rule or ruin, with the chances favoring the latter outcome.

"This is no way to build up an American merchant marine. It will not help to develop our tonnage actually at sea. It will, however, continue and aggravate our present losses, which are averaging much over $4,000,000 per month. There is only one way out of the situation, and that is to sell the vessels as steadily and fairly as possible, cutting down the Government's liability and retiring from business as fast as possible, while at the same time adopting such legislation as will make it practicable to operate the ships in private ownership at a fair rate of charge to the public.—*The Literary Digest*, 28 April, 1923.

BERTHS FOR GIANTS.—Albert D. Lasker, Chairman of the Shipping Board, became quite excited and wrote a letter to Mayor Hylan of New York when he learned that the Government's great ship, *Leviathan*, might not be able to find a pier in Manhattan.

He wrote: "The *Leviathan* is the property of the United States Government and is operated by the Government and therefore it is the property of all the people in the United States. . . . It seems unbelievable that the *Leviathan* should be excluded from the pier in New York owned by the citizens of that city."

The situation is this: there are five ships serving the port of New York which require 1,000-foot piers: The *Majestic, Bergengaria, Olympic, Homeric* and *Aquitania*—all operated by British lines. When the *Leviathan* comes into service on July 4, she will be the sixth ship of this class. The British vessels have been using the Chelsea piers, which, originally not so long, were extended during the War for the use of these long ships. The City of New York is also building a series of 1,000-foot piers farther north along the shore of Manhattan. Pier No. 86, at the foot of 46th Street was the first completed. The War Department has declared that the extensions on the Chelsea piers obstructed the channel and must be removed. British steamship officials believed they had an understanding with the city that they might then lease Piers 86 and 88 (under construction). When the *Leviathan* came along it brought a situation by which either it or the British vessels would be left without docking facilities in Manhattan.

Naturally, both the Shipping Board and the British lines showed anxiety. The solution, however, appears to have been found. Secretary of War Weeks indicated that he would not insist on the removal of the extensions on the Chelsea piers until the city had provided other 1,000-foot piers for the British vessels. Meanwhile, it appears that the *Leviathan* will be leased Pier 86.—*Time*, 5 May, 1923.

NO DOCK FOR "LEVIATHAN."—New York, May 17—The Sinking Fund Commission today instructed Dock Commissioner Delaney to visit Chairman Lasker of the United States Shipping Board with a threat to withhold docking space in Manhattan for the reconditioned giant liner *Leviathan*, unless he reconsidered his decision not to award the contract for reconditioning the *President Buchanan* to the Brooklyn Navy Yard.

The city's ultimatum came when the shipping board's application for use of Pier 86—the only available pier on the Manhattan side of the harbor long enough for the *Leviathan*—was laid before the sinking fund commission. Action on the application was postponed for two weeks.

The city's threat was the climax of a series of protests against the awarding of the *President Buchanan* contract to the Newport News Shipbuilding Company, which entered a bid $400,000 in excess of the cost at which officials of the Brooklyn yard estimated they could do the work.

Men are being laid off at the yard because of lack of work.—*Boston Evening Transcript*, 17 May, 1923.

ENGINEERING

A Proposed 40,000 Horsepower Motor-Ship.*—The motor passenger liner of 13,000 brake horsepower now under construction at Fairfield, England, represents a notable advance in the process of the motor-ship. Since it is a four-shaft vessel, the engines themselves are of comparatively moderate power, and all of the essential problems have long since been dealt with and solved satisfactorily. It is perhaps interesting to speculate upon the maximum power per unit that may be obtained without taking either undue risks or departing from the general design of present-day single-acting two-stroke-cycle engines. As the machinery installations of all merchant vessels, with the exception of fast passenger liners, will certainly fall within this maximum, it is proposed to examine a project for a naval vessel having four shafts and developing 40,000 b.h.p. with eight-cylinder engines running at 170 r.p.m. The proposed machinery would be as follows:

	Main Engines	Auxiliary Engines
Number of engines.....	4	4
Number of cylinders, per engine...	8	4
Diameter of cylinder, inches.....	33.37	18.54
Stroke of cylinder, inches.....	43.2	53.55
Brake horsepower, per engine.....	10,000	1,000
Indicated horsepower per engine..	12,600	1,430
Revolutions per minute.....	170	240
Piston speed in feet per minute....	1,224	942
Indicated mean pressure, lb. per.... sq. in.	94.5	92

The scavenging-air turbo-blowers and the cooling-water pumps are electrically driven and absorb per main engine approximately 700 b.h.p. which is supplied by the auxiliary engines.

The total weight of the main auxiliary engines, turbo-blowers, pumps with their motors, air reservoirs, compressors, silencers, etc., is about 2,750 tons. The weight is thus 150 lb. per brake horsepower, which compares with about 70 lb. per brake horsepower for submarines, and 290 lb. for ordinary cargo vessels fitted with Suzler two-stroke-cycle main and auxiliary engines.

In accordance with the usual practice for naval machinery, the piston speed is higher than in other types of engines, but this does not present any difficulty in regard to scavenging and charging the cylinder, while as regards the mechanical arrangements, due consideration is given to reducing the reciprocating, and rotating masses by using material of greater tensile strength. In submarine engines built by the M. A. N. Co., piston speeds as high as 1,470 ft. per min. have been successfully realized in practice without excessive wear of the pistons or bearings.

A very moderate indicated mean effective pressure of only 94.5 per sq. in. has been chosen, which should allow for a good margin of overload. The 1,250 brake horsepower engines in the *Conde de Churruca* have worked continously for long periods at an indicated mean pressure of

* Extract of paper read before the Institution of Engineers and Shipbuilders in Scotland, January 16, 1923, at Glasgow, Scotland.

about 117 lb. without any visible signs of overload, and with a clear exhaust.

Progress has been in the direction of simplifying the castings of liners, cylinder covers and pistons, and in providing large cooling-water spaces free from any obstruction. It has also been found possible, owing to improvements in design, to lessen the thickness of material in these parts, thereby reducing stresses due to the temperature difference between their inner and outer surfaces. On the whole the thermal conditions in the proposed design are more favorable than in either the experimental 2,000-hp. single-cylinder engine or the 6-Z-300 (1,800-hp. six-cylinder) engine, which has been in service for about six years.

The weight of the proposed engine per cubic foot of cylinder volume lies between the weight of a stationary engine and that of a submarine engine when measured on the same basis. The submarine engine, owing to limited headroom, requires a small stroke-bore ratio—namely, 1.05—whereas the proposed design allows a ratio of 1.3, which is more favorable, as it increases the mechanical efficiency from about sixty-eight to seventy-

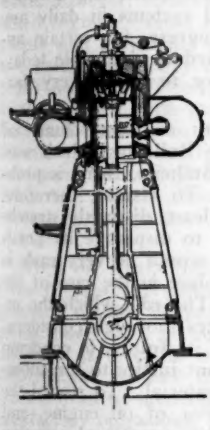


FIG. 1. Proposed 10,000 Horsepower Sulzer Diesel.

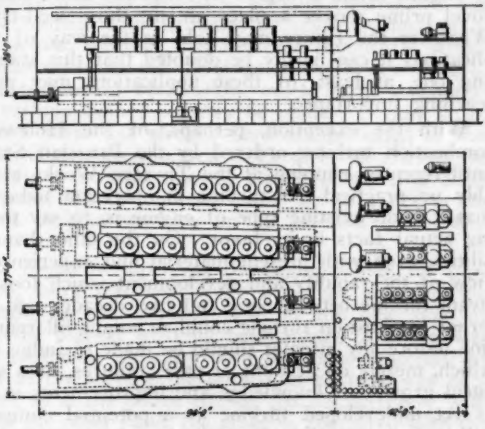


FIG. 2. Arrangement of four engines of Board Ships, together with necessary auxiliary machinery.

four per cent. Taking into account the comparatively light moving masses, the total weight allows sufficient material to be put into the bedplate, framing and cylinders to insure adequate rigidity of the whole structure.

Fig. 1 shows a section through the engine, which does not differ in any essential feature from the standard Sulzer marine Diesel. The general arrangement of four engines in a ship of 77-ft. beam, the machinery occupying a space 136 ft. long, appears in Fig. 2.

Among the advantages of the Diesel over steam machinery for naval vessels are:

1. Increased radius of action on a given fuel supply. In the proposed installation the fuel consumption would not exceed 185 tons per day.

2. The ability to proceed to sea on short notice.

3. Absence of uptakes and funnels, with consequent advantages in the disposition of armament and in less vulnerability to attack from above, owing to the reduced area of openings in the armor deck. In an aircraft carrier a perfectly free landing deck can be easily provided.

4. Risk of being put out of action by damage to steam pipes or boilers is entirely eliminated.

These advantages would appear sufficiently important to induce naval constructors to study the possibilities of high-powered Diesel engines, the employment of which in naval craft would doubtless lead to results not less far reaching than may be confidently expected from the 13,000 brake horsepower passenger liner now under construction.—*Power*, 15 May, 1923.

THE GAS TURBINE IN THEORY AND PRACTICE.—The fundamental difficulties in the way of applying the internal combustion cycle, and the use of "gas"—or, rather, of the products of internal combustion—as the working medium in the turbine form of engine, must always remain. The question today is not so much one of whether this type of engine can be made to render economical results at all comparable with those obtained from the heavy oil engine—for, at the moment, this is quite impracticable—but whether an internal combustion turbine can be produced which can, in view of the intrinsic advantages of the turbine over the reciprocating form of engine, attain a degree of reliability and efficiency which will afford a novel prime mover a place among those well-tried systems in daily use. Whatever the future may hold in the way of progress, for certain applications it can hardly be doubted that this standard is obtainable today, and one, at least, of these applications may prove to be of very far-reaching importance.

With the exception, perhaps, of the Holzwarth constant-volume oil combustion turbine, ordered by the Prussian State Railways, which was, until recently, running at the Thyssen Works at Mulheim, there is probably no practical gas turbine in operation today. To assume, therefore, that it is an existing type of engine is, to say the least, distinctly stretching actual facts in its favor. On the other hand, to disparage its possibilities, even with present material and experience, would be very rash in view of the rapidity and development which took place in the case of the steam turbine between one and two decades ago. The *rôle* which the internal combustion turbine could or might fill requires thorough consideration before any attempt should be made to judge of its future, to condemn which, merely on account of past failures, does scant justice to the subsequent growth of knowledge and improvements in material. To regard the as yet undeveloped turbine as a potential competitor of oil engine, and still more to repudiate its prospects on account of the exceptional economy obtained by the latter is to take far too narrow a view of the functions which the gas turbine may eventually prove able to undertake without encroaching on existing types for many a year to come. It is undoubtedly with the steam engine (or turbine) *and its boiler and condensing plant* that the gas turbine will prove a formidable competitor, and it has a long road to travel before this really becomes of serious commercial importance. The start may be made any day, even if it may not fairly be considered to have already begun.

Economical as the gas or heavy oil engines undoubtedly are, they are —the latter especially—restricted in power per unit not merely on account of cylinder dimensions limited by the heat stresses in the liner, which are so often quoted as if they were the sole factor concerned, but their design is also very considerably transformed by the revolutions permissible for a given power, which, as with the steam piston engine, result in vast dimensions and weight per unit of power compared with those figures obtainable when, as with direct-connected land or geared marine turbines, an almost unfettered choice of speed of rotation can be made. It is in the obvious advantages conferred by the latter quality that the possibilities of the gas turbine very largely lie, if indeed it is ever to be regarded as

a potential competitor in the field of internal combustion. The heavy reciprocating oil engine is very far indeed from being a universal prime mover—its many various types war amongst themselves in a struggle for the evolution of the fittest—and in spite of being able to develop a shaft-horsepower with something like double the overall thermal efficiency of the best steam generating station, the proposition of central station power so developed in Great Britain is slightly less than one-half of one per cent! At present its main field lies in certain branches of marine work, the number of which is rapidly extending on account of the well-proved qualities of reliability and economy combined. The real scope for the internal combustion turbine will be found in certain cases where, in competition with steam plants, the elimination of the boiler and condensing installations offer peculiar advantages, while in others, such as the utilization of blast-furnace gases, the fact that it can be made to develop large powers on comparatively small dimensions, may even in spite of possibly inferior thermal efficiency, render it a suitable alternative to the large gas engine. Until, however, some well-thought-out design is actually constructed and tested engineers must rest content with estimates of efficiency instead of proofs, and it remains to be seen whether they are of a sufficiently attractive nature to justify embarcation on the development of a new type of prime mover. Without experimental verification, much further progress in the design of the gas turbine cannot possibly be made. It may be of interest, therefore, to review what has already been accomplished in this direction, and, in the light of modern research work directed toward the solution of kindred problems, to indicate how the results obtained in other fields than merely those under discussion have gone far to assist in the eventual development of a turbine working on an internal combustion cycle.

When the steam turbine began to supersede the piston engine for purposes of power production, there was no change whatever in either the pressure or the temperature of the working fluid in the new type of prime mover, and because the highest working temperature of steam was not such as to cause any particular difficulty with the usual materials of construction, the fact that in the turbine the admission of heat was constant instead of intermittent as in the piston engine, did not interfere with satisfactory operations. On the other hand, the absence, compared with the piston engine, of all metallic surfaces in contact was eventually found to allow a very considerable increase to be made in the degree of superheat that could be applied, thus incidentally considerably extending the thermal range of the heat cycle at the upper end. But the highest constant pressures and temperatures adopted today in steam turbine practice are, after all, only about 250 lb. and 250 deg. Fah. superheat, or a total temperature of about 650 deg. Fah., though in a few special stations boiler pressures of nearly 400 lb. are being adopted in conjunction with maximum steam temperatures of about 750 deg. Fah. at the turbine. If this temperature be admitted to the high-pressure blading of a reaction turbine, it must be remembered that the initial blade speed used at that point is only about 200ft. to 220ft. per second at most, and that the centrifugal stress on the rotor material is therefore very low. If it be admitted through a nozzle on to the first wheel of an impulse turbine running with a peripheral velocity of about 600ft. to 700ft. per second, it must be realized that the total temperature will be reduced by some 150 deg. to 200 deg. Fah. in the passage through the stationary nozzle, and that consequently the wheel will be rotating—but in the first stage only, of course—in a medium of about 600 deg. to 550 deg., a figure hardly sufficient to affect the strength of the material. These figures are below the final temperature due to the single-stage adiabatic compression of air

to pressures exceeding ten atmospheres; they are roughly 200 deg. Fah. below the open flash point of heavy oil, and about one-fifth and one-sixth respectively of the maximum temperature of explosion in a Diesel cylinder, or that found in an oil-fired boiler furnace. These latter temperatures exceed that of the melting point of steel, and are only permissible in the former on account of the intermittent nature of their application, coupled with a system of cooling, and in the latter on account of the very rapid transmission of the intense heat into the water on the opposite side of the metal. In the constant-pressure internal combustion turbine, the application of heat at its maximum is constant; both in it and in the constant-volume type the blading is subject to a constant impinging temperature, although one of reduced intensity, but in both cases the function of the material is to withstand the heat and, as far as possible, not to transmit any of it. It will immediately be realized, therefore, what considerable differences and difficulties are involved in the use of internal combustion products, whether expanding in a cylinder against a piston or impinging upon a turbine wheel through a nozzle, for the maximum reduction in initial temperature that can efficiently be used in the latter case is only in the region of 1,000 deg. Fah., and therefore the temperature in furnace, combustion chamber, or explosion chamber, and that on the blading can only be separated by about this amount. This very high initial temperature of the working fluid at first involved very considerable mechanical difficulties, even in the intermittent working of the reciprocating oil engine. It has hitherto almost entirely frustrated the solution of the gas turbine problem, and nearly, if not all, the serious difficulties encountered arise from this one element—the initial temperature. The constructional troubles likely to be created from this cause react on the entire proportions of the design, and in order to obviate them recourse must eventually be had to improving the heat resisting properties of metal. At present it is necessary either to restrict the initial temperature to such a point that, with the nozzle drop, the impinging temperature—probably the cardinal point in all gas turbine design—does not cause deterioration of the blading, or else to accept some form of intermittent working, either of which will reduce the amount of positive work obtainable from the cycle or involve a more elaborate machine. The nature of the internal combustion cycle—to which we shall later refer at length—completes the chain of difficulties, because, if the turbine operates on the constant-pressure cycle, the proportion of negative work to the available positive then becomes unduly large; while if it operates on the constant-volume cycle, the positive work obtainable can only be developed in a multi-chamber machine which, compared with other forms of prime mover, is unduly large and complicated. No; the problem of the internal combustion turbine is not an easy one, but it is far from being an insoluble one, and although hitherto these difficulties have indeed seemingly proved too great, it must be remembered that the subject is one which has been largely neglected for some years. Moreover, the real point at issue must always be borne in mind; there is no question at all of evolving an internal combustion turbine which shall be saliently superior to the present oil engine, just as the steam turbine proved to be the reciprocating engine; economically this is probably impossible with a non-condensable gas. The real question is whether, in spite of these limitations, and the difficulties which are liable to arise if they are exceeded to any extent, a gas turbine can be produced which will compete with the steam engine and its accessory plant.

So considerable has this temperature difficulty proved in the past, that from the majority of the small experimental gas turbines which have been made during the last thirty years there is absolutely nothing whatever to

learn of a positive nature. The writer has troubled to investigate the history of a dozen or so, and has been more or less indirectly associated at various times with perhaps half a dozen others which came into being largely as the success of the steam turbine began to appeal to enthusiasts with elementary knowledge of the petrol engine, but none of the principles of turbine and compressor design. Most of these little machines were far too small and inefficient to prove anything at all, and their accessories were generally far too crude to admit of proper trials being made; little or no provision was made for taking any measurements of performance, and in most cases their very existence is now remembered only by the interested few who recall the episode merely as one involving useless expenditure. In none of these cases, totalling nearly a score, was any published statement ever made regarding even the existence of the machines, and it serves no purpose to recall these efforts were it not for two or three facts that have some bearing on the subsequent history of the gas turbine. Not only has the lack of success left behind an unfavorable impression, but in some cases has definitely proved sufficient to deter originators from re-embarking in after years on similar experimental work in spite of the growth of modern knowledge on the subject. Secondly, the collective experience gained has very clearly demonstrated—if further proof were, indeed, needed—the folly of attempting to obtain in one step too comprehensive a result when so many individual subjects for experiment are at one time involved. In precisely the same way it was afterwards found in experimenting with oil engines, that it was radically wrong to embarrass important mechanical experiments with simultaneous attempts for instance, to burn inferior qualities of coal. Again, a turbine, except for such a unique design as the Laval type, is not a very satisfactory small output machine, even for steam; with gas as the working fluid it is even less so on account of the very much smaller volume per pound, and a great fault in many of these early designs was the fact that the possible shaft horsepower, exclusive of any work of compression, was much too small to admit of any reliable measurements for temperature, consumption, efficiency, etc., being made. A number of isolated experiments on details connected with the internal combustion turbine problem, which can be conducted at relatively small cost, require to be carried out before a further attempt to produce a complete working installation is made. It is surprising how often, simply for the sake of cheapness and convenience, experimenters have utilized an old Laval steam turbine for absorbing the kinetic energy of their products of internal combustion.—*The Engineer*, 4 May, 1923.

AERONAUTICS

What The Various Countries Are Doing In Aviation.—Soviet Russia has begun the development of a great commercial and military aircraft program, and occupies an important position in the international race for supremacy in the air, according to the Aeronautical Chamber of Commerce, which has recently given to the press its annual survey of aviation throughout the world. The report, covering flying activities in fifty-eight countries, gives France the leadership among the nations in both commercial and military aviation. The Germans are said to be going ahead, in spite of the heavy handicaps imposed by the Peace Terms. The complete survey, beginning with the activity in Russia, runs as follows:

Russia is using German, French and Dutch airplanes. Special aviation schools have been established at Toula, Moscow, Smolensk, Kharkow, Pola, Ekaterineslaw, Mokilaw and Petrograd. The Council of Commissaries has voted to obtain 300 new airplanes for the Red Army. It is reported authoritatively that 100 planes have been bought from Italy. In four cities

the government has established domestic aircraft factories. The program for the year is fully to equip seventy fighting squadrons.

In all, the Soviet Government's program calls for 5,000 airplanes with spare parts. With the assistance of German aeronautical experts plans have been made for exploiting vast territories. Great trunk lines have been charted. It is proposed to have in operation by 1926 many thousands of aircraft. German pilots are expected to join the comparatively few Russian aviators on the commercial lines.

France, in developing the colonial air defenses, operates a passenger and mail service three times weekly between Algiers and Biskra, another between Oran, in Western Algeria and Casablanca on the west coast of Morocco, twice weekly. During the first eleven months in 1922 the French built 3,300 airplanes for military and commercial purposes, and let orders for 1,200 additional machines. The French program for 1923 calls for 220 air squadrons, with ten machines to a squadron, or 2,200 planes with 100 per cent reserves. French air appropriations were greater in 1922 than all nations combined, aggregating $84,591,755.

In 1922 all the French air-lines operating to Africa, London, Brussels, Amsterdam, Tunis, Constantinople, Genoa and other points, in all, fourteen distinct air-lines, flew a total of 2,146,234 miles, carried 14,397 passengers, 1,165,216 pounds of parcels, and 90,580 pounds of mail. It is planned to link all possessions from Indo-China to Guiana, through Africa and the Republic within two years. Aviation is being taught in the schools and colleges, and a completely equipped French mission is making a tour of the world, and giving demonstrations in Europe, Asia, Africa, and South America.

Great Britain has centralized her aviation in the Air Ministry. Her Royal Air Force numbers 3,000 officers and 26,500 enlisted men. There are thirty-three squadrons—twenty-one of them in the colonies, the Near East and India, and twelve in the British Isles. The Air Ministry employs 4,382 civilians. Approximately $54,000,000 is being spent for aviation, including $11,000,000 for construction and $2,000,000 for civilian aviation. The air estimates for the next fiscal year approximate $94,000,000.

In Italy Premier Mussolini recently placed the air service on a par with the Army and Navy. Several new squadrons are being organized, and many projects for operating semi-governmental airship service have been begun. Approximately $3,000,000 is being spent for new construction.

In 1922 Japan appropriated $11,304,873 for naval aviation, of which $1,586,924 is being spent for construction of new planes. About $16,000,000 is being spent on military aviation, a fourth of it for new equipment. The Government is providing subsidies and liberal rewards for civilian aviation.

German aviation, though handicapped by the treaty terms, is progressing. German engineers are active, and manufacturers of aircraft are building machines in Switzerland, Italy and Russia, and possibly in Finland and the Scandinavian countries. In addition they are most active in Asia, Soviet Russia and certain South American Republics. The German Government in 1922 appropriated 22,000,000 marks in subsidies for German commercial air-lines. The Hamburg-American and North German Lloyd lines are interested in several aerial projects, including both airplanes and airships. There are five other aerial operating companies. For many months they have been operating between Germany, Russia and the Baltic States, and Switzerland.

Other countries which have relatively extensive aerial programs this year include Argentina, Australia, Belgium, Bolivia, Brazil, Canada (and all other countries in the British Commonwealth), Chile, China, Colombia, Cuba, Denmark, Holland, Ecuador, Esthonia, Finland, Honduras, Hungary, Latvia, Lithuania, Mexico, Norway, Paraguay, Peru, Poland, Portugal,

Roumania, Russia, Siam, Spain, Sweden, Switzerland, Turkey, Uruguay and Venezuela.

Mexico is spending $1,495,500 on her air-service, and while the Government has purchased a number of planes in the United States, it is planned to buy 200 machines in Europe during the year.

Spain learned a lesson in the Moroccan campaign, and since then has provided a market for all European constructors. In addition to active expansion of military aviation, daily air services are being operated. A transatlantic airship service is projected to be supported financially by the government.—*The Literary Digest*, 12 May, 1923.

BUILDING DIRIGIBLE TO CARRY TWELVE PLANES.—The giant semi-rigid airship now being constructed at Akron, for the Army Air Service, is to be used as an airplane carrier. Plans are practically completed, it is stated, for equipping the great dirigible with twelve small fighting planes, which cannot only be picked up by the airship while both are in flight, but which also can "take off" from the moving airship.

Experiments just completed at Mitchell Field, Mineola, L. I., have proved incontrovertibly that airships can be used as airplane carriers, Air Service officials state. While the general type of apparatus for picking up the planes and for launching them has practically been determined, it is possible that further experimentation will result in slight modification of their apparatus.

In the experiments at Mineola, which till now have been kept secret, a large ring was placed on the upper wing of the airplane, and a hook of considerable size was suspended from the basket of the airship. After the airship was in full flight, the airplane pilot flew under the basket of the airship, regulating his speed to that of the dirigible. Since the equality of speed gave practically the same effect as if both machines were standing still, the picking up of the airplane was accomplished quite easily. No mishap of any character was experienced during the experiments, army fliers assert.

The great airship which will be used as an airplane carrier, is one of three contracted for by the War Department with the Goodyear Tire and Rubber Company. One of these, the *TC-1*, was recently completed, and is now undergoing trial flights, following which she will make a cross-country flight to Niagara Falls and return.

Though the *TC-1* is the largest semi-rigid airship ever built in America, she is scarcely one-third the size of the ship which will be used as a carrier. The *TC-1* has an envelope capacity of 200,600 cubic feet, while the new ship will have a gas capacity of 750,000 cubic feet and will be the biggest semi-rigid in the world.

The new airship, which will probably be called the *TC-2*, will be completed about September 1. In size she will be somewhat smaller than the ill-fated *Roma*, which was burned at Hampton Roads, Va., more than a year ago with great loss of life. In lifting capacity, however, she will be superior to the *Roma* and, according to air officers, she will be much safer. The board of inquiry which investigated the *Roma* disaster found that the great loss of life was due primarily to the conflagration resulting from the ignition of the hydrogen gas which inflated the envelope. The new ship will be so constructed as to permit of inflation with helium, which is non-inflammable, and army experts assert advantage has also been taken by the engineers of the lessons learned from the *Roma* disaster in avoiding certain weaknesses of construction. The new ship also is expected to have greater speed and maneuvering ability than the *Roma*.

The Army Air Service for more than a year has been studying the problem of utilizing airships as airplane carriers. As a matter of fact,

it was the expectation that experiments along this line might be conducted that the army decided to purchase the *Roma* from the Italian Government. Tentative plans for such experiments already had been worked out and would doubtless have been put into effect but for the disaster to the *Roma*.

Since that time still further study has been made of the problem and activities of other nations in this respect have been investigated with the result that plans are now practically complete.

Under the naval treaty adopted at the Washington arms conference, an absolute limitation is placed on the number and tonnage of naval airplane carriers which any of the signatory powers may have.—*Aerial Age*, May, 1923.

FLEET AVIATION AT PANAMA.—One of the striking examples of the high state of efficiency of the fleet was the performance of the squadrons of scouting planes which accompanied the fleet to Panama and took part in the tactical exercises.

The eighteen scouting planes arrived in Panama after a 2,400 mile journey by air from Hampton Roads, and, with scarcely more than time to make minor adjustments and refuel, were sent out on the scouting line on a problem involving fifteen thousand plane miles of flying.

When the scouting squadrons have returned to their base at Hampton Roads they will have completed in the neighborhood of 130,000 plane miles of flying during the southern cruise. This is aside from the Torpedo Squadron which proceeded to Key West from Hampton Roads and was based there for exercises during the winter.

The presence of the aircraft carrier *Langley* at Panama was inspiring and informative to many who had not been in close touch with the development work that has been going on in connection with the planes for the new aircraft carriers. Practical demonstrations of flying off and landing on the deck of the *Langley* were given off Panama and many enthusiastic words of praise were expressed for the work that had been accomplished.—*Aviation*, 23 April, 1923.

ORDNANCE

GUNS NOT TO BE ELEVATED.—With approval of the President, announcement was made April 26 by the Navy Department that money appropriated for the elevation of guns will not be used for that purpose. Following is the statement:

"During the discussion at the last Congress of the proposal to appropriate $6,500,000 for elevating the guns of thirteen battleships of the United States Fleet certain statements were made in regard to the disparity between the ranges of guns of the ships of the British fleet and those of the fleet of the United States. These statements were made in absolute good faith, but were shown by later reports from the government of Great Britain to have been exaggerated. While the disparity does exist, it is not so great as was then supposed.

"Upon the representations of the Navy Department, Congress appropriated the sum asked for. In view of the discrepancy between the statements of the Department and actual conditions, the Department has determined not to employ the money appropriated for the purpose of increasing the elevation of the guns of the American Fleet, until further directed to do so by Congress.

"This course has the President's approval."—*Army and Navy Journal*, 28 April, 1923.

TO TEST "MARYLAND'S" 16-INCH GUNS.—Washington, April 25—Important gunnery exercises will be staged about June 1, at the mouth of the

Potomac River, when the 16-inch guns of the U. S. S. *Maryland* will be thoroughly tested. Except for a few shots which were fired for inspection purposes when the dreadnaught was commissioned, this will be the first time that these guns, the largest on any of our naval ships, have ever been used. The firing will be witnessed only by Secretary Denby and the ranking officers of the sea establishment, for it is the intention to make the exercises secret. They will be held for experimental purposes only and probably will result in changes being made in gunnery rules and regulations.

Every possible test will be made of the great guns for calibration purposes during the exercises. Airplanes hovering over the target will take photographs of the fall of the shots and "correction" photographs will be taken from a ship riding at anchor near the target and from an observation point on land. These photographs will be forwarded to the division of gunnery exercises and engineering at the Navy Department, where studies and deductions will be made, giving the Navy its first authoritative information as to the value of the guns and what they can do in time of war.—*Boston Evening Transcript,* 25 April, 1923.

Advanced Rules for Gunnery Exercises.—Rules and regulations for gunnery exercises during the year commencing July 1 next are in course of final revision. The practices next year will be more advanced in ranges, methods of firing, and the number of calibers fired at the same time, and the requirements will be more rigid with respect to this allowance.

The program for gunnery and other exercises of submarines next year will be on a more advanced scale with respect to the character of firings and the speed and course of the targets. In engineering the submarines will be required to work on a fuel allowance on a competitive basis similar to that pertaining to battleships. A certain amount of fuel will be allowed for miles steamed, based on speed at the time, this allowance including the fuel used in charging batteries. The relative standing of submarines in engineering will be determined by the amount of the allowance used.

Aircraft also will be on a competitive basis as to gunnery next year, as in the case of surface craft and submarines. Aircraft will be required to operate under conditions approximately as closely as possible those of war. The program calls for a number of kinds of gunnery practice, and all types of weapons carried will be required to be used.—*Army and Navy Register,* 12 May, 1923.

British View of Long Ranges.—While it is natural enough that American naval officers should wish to have guns of maximum range, it seems doubtful if the fuss now being raised on this point is justified. According to their reports, the 16-inch guns of the *Maryland* class (three ships) are the only weapons in the fleet that can shoot up to 30,000 yards, the extreme range of the 14-inch gun in other battleships being about 23,000 yards. Ten years ago this latter figure would have been thought more than sufficient for all requirements, but today, it is claimed, accurate firing at sea is possible at 25,000 yards, if not beyond that distance, and as gunnery methods continue to improve it may soon be feasible to place shells on a target seventeen miles distant. Therefore, say the Americans, as the first hits may decide the issue of an action, it would be courting defeat to engage an enemy whose guns had even a slight superiority in range.

The view held by most British officers with war experience is that 25,000 yards represents the outside limit for effective gunnery with the heaviest weapons now mounted afloat. Hits above that range would be "flukes." Nor do they anticipate any substantial increase in effective range

by the adoption of improved fire-control methods or aircraft spotting. This is because the ballistic properties of the 16-inch gun cannot be relied on for a greater range than 25,000 yards, and heavier calibers are banned by the Washington Treaty. There would be more scope for development in long-range shooting if guns of 18-inch and 20-inch bore were introduced, but this is now impossible. In the naval actions of the war shots were fired at 20,000 yards, but there is no proof of any hit having been made above 18,000 yards. In fact, the "effective range"—i.e., that at which a reasonable proportion of the shells fired were likely to hit the target—was found to be about 16,000 yards, even when visibility was high. British naval men are, therefore, inclined to reject the theory that future actions may be decided at any range above 25,000 yards, and not a few of them consider this to be too liberal an estimate.—*Naval and Military Record*, 25 April, 1923.

RADIO AND NAVIGATION

NEW TELEGRAPH ALPHABET.—The chief signal officer of the Army, General George O. Squier, announced at the annual meeting at the National Academy of Sciences in Washington on April 24 the invention of a new usiversal alphabet, which applies to radio, land lines and submarine cables.

General Squier explained the principles of this new alphabet in his paper and exhibited illustrated forms of apparatus for transmitting and receiving the messages. The new alphabet is 2.65 times faster than the present International Morse alphabet, now universally employed. General Squier pointed out that the present telegraph alphabet was invented by Professor Morse over eighty years ago, and long before the telephone, the alternating current art, or radio were known. He stressed the point that the old alphabet is entirely out of date and not suited for telegraphy as we know it today.

The principle upon which the new alphabet is based is that the dots and dashes occupy equal lengths of time and no consecutive signals are of the same sign, and the limit of legibility for each letter of the alphabet is practically uniform. In the new alphabet the dots, dashes and spaces are differentiated by different intensities of the sinusoidal wave employed, in exactly the same manner that music and speech are formed. In fact the principles of the new alphabet serve to bring telegraphy in line with telephony, and base the two arts on the same fundamental principles of modulation. Experts of the Department of Commerce, the Navy Department and the War Department are enthusiastic over the possibilities and improvements to be effected by this new alphabet.

General Squier pointed out in his paper that this method of transmitting messages offers a plausible solution of the problems of interference and of "static" elimination, and also of multiplexing a single radio frequency channel. Finally, the realization of a single telegraph alphabet based on modern scientific principles to replace the three or more alphabets now in use for land lines, radio and submarine cables would result in wonderful economies in the unification and speed of the world's telegraph traffic.—*Army and Navy Register*, 28 April, 1922.

NEW RADIO CONTROL ON BATTLESHIPS.—Responsible naval officials are planning the installation of radio control on two battleships which will replace the *Iowa*, sunk in Panama Bay during the naval maneuvers last month. The ships to be selected as the target for naval gunners probably will be the *North Dakota* and the *Delaware*. Formal announcement of their selection and of the decision to continue the use of radio control will be made shortly after Admiral Eberle succeeds Admiral Coontz as chief of operations. It may be said at this time that the greatest care will

be exercised in installing the apparatus on the two ships and that it will be far superior to the device by which the *Iowa* was operated. Particular attention will be given to the lessons which were learned during the recent maneuvers. It will be recalled, among other things, that the radio control of the *Iowa* did not work properly during the second day's firing, when 14-inch shells were used. The ship barely moved through the water, instead of making eight or ten knots, and did not change her course, as she was supposed to do. The supposition at that time was that the hits scored by the first few salvos put the apparatus partially out of commission. Investigation has satisfied gunnery experts that such was not the case. Many of the observation ships were sending radio messages on varying wave lengths during the firing, and it is the belief now that these messages interfered with the wave length used by the control ship *Shawmut*. The experts are said to be satisfied that the apparatus in itself was not damaged. In outfitting the *North Dakota* and the *Delaware*, everything possible will be done to protect the parts of the ships in which the apparatus will be installed. It is probable, too, that during gunnery practice in the future the radio instruments on the observation ships will be silenced. The announcement to be made in June also may set forth that two ships other than the *North Dakota* and the *Delaware* will be placed under radio control to be used by airplanes in bombing tests.—*Army and Navy Register*, 28 April, 1923.

MISCELLANEOUS

DISARMAMENT.—Reuter's Agency understands that several questions dealing with disarmament will be discussed at the twenty-fourth session of the Council of the League of Nations, which meets in Geneva on the sixteenth instant. Among these are the resolutions of the last Assembly dealing with (1) the reduction of national expenditure on armaments to the figures of 1913; (2) the private manufacture of arms and the control of arms traffic; (3) the transmission to members of the League of Lord Robert Cecil's draft treaty of mutual guarantee; and (4) the reduction of naval armaments.

It was suggested at the last Assembly that the control of the private manufacture of arms might be discussed at an international conference summoned "at an appropriate moment." The last Council meeting felt the moment was not yet opportune, but the Temporary Mixed Commission, which met in February last, considers that in any case it would be advisable to invite the Government of the United States to make concrete proposals as to the lines on which they would be willing to collaborate with other Governments, both for the control of the traffic in arms and for the private manufacture of arms. The extension of the Washington Naval Treaty to all states which have not yet signed is also to be discussed at an international conference, which will be held after the Santiago Conference.
—*The Naval and Military Record*, 11 April, 1923.

NEW CONFERENCE NOT LIKELY AT PRESENT.—In reply to a question from Commander Bellairs in the House of Commons on Wednesday as to whether the Government were aware that the U. S. Navy Appropriation Act for the financial year, 1923-24, requested the President to negotiate with the leading naval Powers for the restriction of all types of fighting craft below the capital ship, and whether proposals to that end had been made, the Under-Secretary of State for Foreign Affairs said it did not appear that any such request to the President was included in the Act as finally passed, nor had any proposals for a conference been received. So far as the first part of the reply is concerned, the Government's information appears to be at fault, for it was distinctly stated in cable messages at the

time that the amendment to the Navy Appropriation Act requesting the President to open negotiations for the limitation of "auxiliary warships" and aircraft was duly embodied in the Act, as finally passed. It is, however, not surprising that President Harding should have hesitated to open pourparlers in this direction until he had assured himself that the prospects of success were reasonably promising.

As we have pointed out more than once, the limitation of subsidiary naval armaments would be likely to prove much more difficult than that of battleships, and unless the attitude of France, in particular, has undergone a complete change during the last twelve months—of which there is no evidence—a conference aiming at such limitation would almost certainly end in failure. The Japanese view of this question is not definitely known, but when the Premier, Baron Kato, was asked in the Imperial Diet on February 7 whether a new naval competition might not develop out of the current programs of cruiser and submarine construction, he made the following significant answer: "If that should come to pass, I think that another naval conference would be held." But this does not necessarily mean that Japan would be satisfied with the same ratio of strength in small craft that she accepted for capital ships: viz., three-fifths of the British and American totals.

Should any proposals for a new conference on these lines be put forward by Washington, they will no doubt be carefully considered by H.M. Government. It would be no light thing for Great Britain to accept a rigid formula of strength in cruising ships in view of her enormous sea-borne trade and the probability that cruisers will remain for many years to come the only effective means of guarding that trade. To suggest equality in this type of ship as between Britain and the United States would be to ignore the infinitely greater responsibilities and requirements of the former with regard to commerce protection. If the United States ever goes to war, the interruption of its sea-borne trade would not have fatal consequences, as the country is practically self-supporting, and could in any case produce from its own resources enough food and raw materials to carry on for a considerable time without foreign imports.

Our case is vastly different, and it therefore behooves us to think well before entering into any new agreement which might put it out of our power to guard the ocean highways in war time, and thus expose ourselves to starvation and defeat. As for the restriction of all warlike aircraft, also proposed in the U. S. Navy Act amendment, it would certainly be hopeless to attempt anything of this kind at the present juncture. Would France, for example, consent to give up her existing preponderance in air power and accept equality with this country? And would this country be satisfied with anything short of equality with France as a definite standard if relative strength in the air were to be adopted? It is probably because of these and other formidable difficulties which he foresees that President Harding has not yet acted on the proposal of Congress to summon the Powers to a new disarmament gathering.—*Naval and Military Record*, 18 April, 1923.

JAPAN MAY BE WILLING TO EXTEND ARMS PACT.—London, April 5.—Writing in *The Sun* of January 4, I said that the prospect of negotiating a fresh naval treaty, this time for the purpose of restricting auxiliary combatant tonnage, seemed unfavorable, owing mainly to the attitude of Japan and France. Neither of these powers, it was pointed out, had evinced any willingness to accept a limit of strength in cruisers or submarines, and as both had begun work on auxiliary programs since the conference, it was hardly to be expected that either would take kindly to

the notion of a new agreement which aimed at regulating the future amount of such tonnage on the ratio prescribed for capital ships.

I therefore expressed doubt as to whether the time was ripe for calling a new conference to discuss this question, as Congress had authorized President Harding to do. Since that article was written, however, some new facts have emerged which appear to indicate a change in the attitude of Japan, and even suggest that she would now be ready to listen to proposals for extending the original pact.

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The truth is that the Japanese taxpayer, like his Western confrere, is growing restless under the yoke and wants to know the why and wherefore of the armies and fleets which take such a heavy toll of his earnings. He would be ready enough to pay for defense if the country were palpably threatened by a foreign foe, but the Government, so far, has been unable to explain the need for an army which is considerably larger (and more than twice as expensive) than the establishment that was maintained before the World War, when Russia was busy with schemes for extending her power in the Far East and Germany was firmly intrenching in Shantung.

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Having had time to digest the significance of the Washington treaty, thoughtful Japanese have begun to ask themselves why so large a percentage of revenue should still be swallowed up by warship construction. Looking abroad, they can discern no parallel to this piling up of minor naval armaments. Yet Japan, despite the enormous strategic advantage she has gained from the status quo agreement in respect of Pacific fortifications, goes on building cruisers and submarines with an energy which is not inaptly described as feverish.

The official pretext that all these new fighting craft are required for the purpose of defending her vital communications with the mainland cannot be upheld for one moment when the geographical facts are studied. Henceforth, as the *Japan Chronicle* declares, it will be practically impossible for any foreign power to interrupt these communications. "Neither Britain nor America would ever send their fleets so far from home to dispute the rights of the narrow seas with a navy sixty per cent of their own strength" —and, it might be added, with a navy which monopolizes all the actual and potential bases in the Far East, thus rendering foreign naval operations on a large scale in those waters absolutely impossible.

"The Washington agreement," says the *Chronicle*, "has made Japan's position in Eastern Asia vastly stronger. The naval isolation which the *Kokumin* (a militarist organ) regards as a threat requiring special precautions does not, in reality, exist, and those precautions, therefore, cannot be legitimate."

There are, indeed, only two possible explanations for the building of so many small fighting craft: (a) they are designed for attacking the ocean commerce of a future enemy, or (b) they have no particular *raison d'etre* except as a means of maintaining the prestige of the navy at home, and therefore the influence of the naval clique: i. e., the Satsuma clan, which shares with the Choshu, or army caste, the real governing power in the country. Perhaps both these motives are present but in any case Japan does not need the new ships for the defense of her coasts or her communications with China.

It is chiefly because of this heavy shipbuilding program that armament expenditure still absorbs thirty-six per cent of the total budget, a far higher percentage than any other country devotes to the like purpose. It is, therefore, not surprising that in the last session of the Diet there were repeated demands for a revision of the post-treaty naval program on

a downward scale, or that a section of the press continues to call out for drastic reductions.

The official argument that warships must be ordered if only to save the shipbuilding industry from ruin is no longer accepted. What is the sense, ask the critics, of subsidizing one particular trade by ordering superfluous naval tonnage when the national industry as a whole is being handicapped by the high taxation which this lavish outlay involves? The "eight-eight" program was financed, though not without grumbling, because it was deemed necessary as a counterweight to American naval expansion, but now that all danger of foreign aggression has vanished the taxpayers are not in the mood to go on finding the money for ships which appear to be only for show.

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Before any definite steps were taken to summon a new conference it would be prudent to find out the minimum allotments of tonnage with which Japan and the other signatories would be satisfied. It is improbable that Japan or France would agree to apply the battleship scale of strength to these lesser units, and insistence upon that point might wreck the project at the outset. But even if a much higher ratio were fixed for small ships, this would obviously be better than having no limit at all, as at present, for in the latter case the danger of competitive building would always exist.

So far as modern light cruisers and long-range submarines are concerned, Japan has now gained such a lead that for the United States to achieve bare equality with her would necessitate a huge program of new construction, including sixteen cruisers and about thirty large submarines. Whether Japan, on her part, would be content with anything less than parity of strength with the United States in these vessels remains to be seen. As for France, there is no reason for supposing that she would demand an unreasonably high ratio of cruiser or submarine tonnage, though a great deal of tact would doubtless be required to induce her to attend another disarmament parley.

Finally, it should not be difficult to draw up a graduated scale of strength in all war craft below the battleship which would be mutually acceptable to Great Britain and the United States. On the whole, therefore, complete naval limitation does not seem to be beyond the bounds of possibility, though it might prove far more difficult of attainment than battleship restriction turned out to be. At all events, the Japanese Premier has dropped a hint which cannot have escaped the attention of Washington.—Hector C. Bywater in *Baltimore Sun*, 24 April, 1923.

KEEP REDUCING NAVIES, URGES SENATOR KING.—Renewal of the controversy whether the United States should call another international conference for the purpose of still further limiting naval construction among the leading powers may be expected at the next session of Congress.

Senator King, of Utah, Democrat, and prominent on the Senate Naval Committee, has announced that he would offer a resolution requesting the President to call a conference for the purpose of seeking an agreement to limit construction of aircraft, submarines and surface craft of 10,000 tons and less. If the plan of Senator King should be carried out this would mean a second Washington conference.

So far as the further reduction of naval armament is concerned the feeling has been expressed by the Administration that further steps toward limiting armament at sea should await ratification by all nations concerned of the existing naval agreement. Senator Borah strongly urged a conference on economic matters and land and sea disarmament or reduction

of armament, but it encountered opposition from the Administration and from many Senators and resulted in no action.

Senator King, however, intends to press the question of further limiting naval armament from the outset of the next session. He holds that in view of the great development of aircraft and the improvement of submarines it is important this be done.

"The recent wonderful flight of American army officers across the continent without a stop," said Senator King, "is an indication of the possibilities of aircraft. While under the naval agreement made at the Washington conference battleship construction and some other phases of naval construction were limited, it is nevertheless a fact that the leading naval powers are going ahead developing aircraft and submarines and warships under 10,000 tons. England is developing her aircraft, so is France. I have no doubt Germany is secretly developing aircraft. Unless steps are taken to agree to limit construction of aircraft, submarines and vessels up to 10,000 tons it will be only a little while until we are spending almost as much as ever on the navy and much more than before the war."

Senator King holds that the taxpayers will get little benefit from the present naval agreement unless the next step toward naval limitation which he advocates is taken.

Senator King not long since wrote Secretary of the Navy Denby protesting against the proposed expenditures fir lengthening the range of American naval guns. He will offer a resolution when Congress meets to repeal the appropriation.—*Press Dispatch.*

NAVAL BUILDERS BUSY DURING CURRENT YEAR.—London, April 26.—Important additions to the tonnage of the world's fighting fleet will be made during the present year. Preëminent in size nd power are the two mighty battleships, *Colorado* and *West Virginia*, which are scheduled to take their place in the United States Navy next September. Sister ships of the famous *Maryland*, these vessels, like her, were authorized as far back as August, 1916, but owing to war exigencies they were not begun till several years later—the *Colorado* in May, 1919, and the *West Virginia* in April, 1920.

The delay was fortunate, in that it enabled the designs to be modified in line with war experience, and so it happens that the three *Marylands* embody certain improvements in structure, battery and armor which were suggested not only by the battle of Jutland, but also by observations taken while Admiral Rodman's dreadnaughts were serving in North Sea waters as the Sixth Battle Squadron of the Grand Fleet.

Although of nearly 10,000 tons less displacement, the ships of the *Maryland* class are in some respects superior to H. M. S. *Hood*. They have a heavier punch, a longer reach and could probably stand more hammering than the British ship. Bald figures convey no real idea of the enormous destructive power latent in these floating citadels of steal. The *Hood* has a main armament of eight 15-inch guns, each weighing ninety-six tons and having a length of fifty-two and one-half feet. This type of gun can discharge one 1,920-pound shell per minute at a velocity of 2,450 feet per second, and if the gun is fired at its full elevation of thirty degrees the giant projectile will throw up a glittering waterspout some 30,000 yards distant. With all eight guns in action the *Hood* would be hurling 15,360 pounds of steel-cased explosives per minute, and in the course of 10 minutes' salvo firing nearly seventy tons of shell would have left the ship.

But the fire of the *Maryland* would be still more formidable. She and her sisters each carry eight guns of the 16-inch model, which is sixty feet

long, weighs 105 tons and discharges a 2,100-pound shell. A full broadside would thus weigh 16,800 pounds, and the weight of metal fired in ten minutes would be seventy-five tons. Moreover, the *Maryland,* having higher-powered guns mounted at the same angle of thirty degrees, could outrange the *Hood* by several thousand yards. It is well to note this fact in view of all that has been heard about the British fleet's superiority in ranging power.

Next to their tremendous battery of guns, the most striking feature of the *Maryland* class is their massive armor protection. The water line is defended by sixteen inches of steel, which probably could not be pierced at average battle range by any gun now mounted afloat, while the *Hood's* 12-inch water-line cuirass would scarcely be proof against 16-inch shell fired at medium range.

Where the British ship has an unquestionable advantage is in speed. With engines working "all out" she can steam at 31 knots, or 10 knots more than the *Maryland.* The precise value of speed has long been a matter of controversy among naval men, but the balance of professional opinion is now against very high speed if it has to be purchased at the cost of hitting and resisting power, as was done in the *Hood.* The new British battleships *Nelson* and *Rodney,* now building, are 7,000 tons smaller than the *Hood,* but as their speed is limited to 23 knots it has been possible to give each of them a battery of nine 16-inch guns and stouter armor protection.

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The regrouping of the fleets as regulated by the treaty will not be finally accomplished before the end of 1925, when the British ships *Nelson* and *Rodney* are due to hoist the pennant. As soon as they are in commission the four *King George V* class must be scrapped. That being done the British battle fleet will comprise twenty dreadnaughts, of which two will be armed with 16-inch, thirteen with 15-inch and five with 13.5-inch guns. The aggregate displacements of the two battle fleets will be: United States, 525,850 tons; British, 558,950 tons. Great Britain will, therefore, have an excess of two ships and 33,100 tons, in spite of which the United States fleet will have the advantage in number of guns: viz., 182 against 166, though not in weight of fire. If each fleet let fly a full broadside from all its big guns, the weight of metal thrown would be: British, 297,000 pounds; United States, 261,840 pounds.

No capital ships other than the *Colorado* and *West Virginia* will be completed for any navy this year, nor, indeed, for several years to come, but if the limitation pact had not been negotiated, things would be very different. In that event, the current year would have witnessed the completion of four Japanese leviathans—*Kaga* and *Tosa,* each of 41,000 tons, and the *Amagi* and *Akagi,* of 44,000 tons apiece; together with the launch of several 43,000-ton American ships and four British battle cruisers of 48,000 tons each. This herd of mastodons would have formed only the first installment of the world's post-Jutland armada; in a few years' time whole fleets of such monsters would have been at sea, compared with which the *Maryland,* and even the *Hood,* would have seemed insignificant.

But now, in all probability, the new competition in tons and guns would have forced the displacement of new battleships up to 50,000 tons and the cost per ship to $50,000,000.

But if big ship rivalry has ceased the amount of auxiliary tonnage now in hand is considerable, and many of these vessels will come into service during the year. The *Omaha,* which began her preliminary trials on January 30, is the first scout cruiser to be completed for the United States Navy since 1908. This long pause in cruiser construction has left the

American fleet gravely deficient in a most essential arm. Five sisters of the *Omaha* are also expected to join the flag before the year is out, leaving four others of the same type whose date of completion is listed as "indefinite."

In speed, gun power and other qualities the *Omaha* compares most favorably with new foreign cruisers. She is 2,000 tons larger than the standard Japanese type, has a battery nearly twice as powerful and will, if she realizes her designed speed of 33¾ knots be the fastest cruising ship in the world. But the superority of the unit cannot compensate for lack of numbers, and even when all ten *Omahas* are at sea the Japanese Navy will have a clear majority of fifteen ships of this invaluable class. No new British cruiser will be delivered this year. The four now completing were all begun during the war, two of them having been under construction for nearly seven years. In addition a "cruiser mine-layer" has been building since last November.

Japan is working steadily at her auxiliary program which is by far the largest of all. This year she will finish the *Kinu, Yura* and *Abukuma*, bringing her fleet of modern high-speed scouts up to thirteen. These ships are mostly of 5,500 tons—against the *Omaha's* 7,500 tons—and carry only seven 82-pounder guns against the American ship's twelve 100-pounders; but they are very fast, all having made 33 knots.

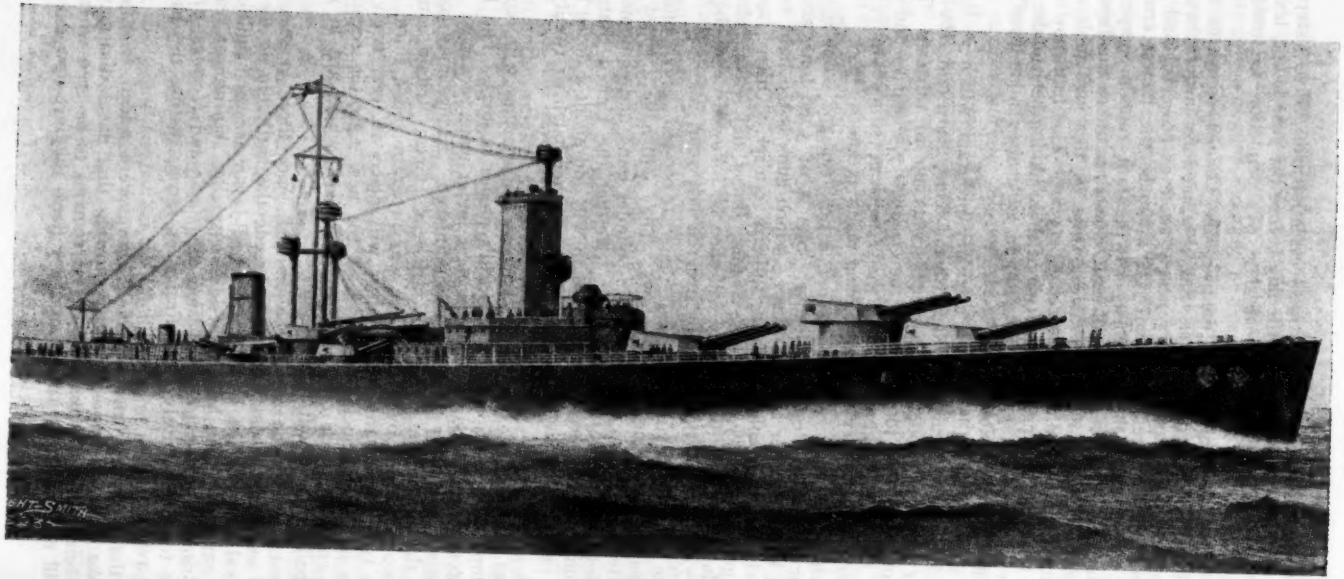
On March 5 was launched the *Yubari,* a new type of scout specially designed for service as destroyer leader. She is of 3,100 tons, and can travel at 33 knots, but her battery of six 5.5-inch guns is too light to give her much chance in combat with a full-size cruiser. Other Japanese cruisers to go afloat this year are the *Sendai, Jintzu* and *Naka,* belonging to the standard 5,500-ton type. They will soon be followed down the ways by the big 7,000 and 10,000 ton ships ordered last year.

From the meager details disclosed these 10,000-ton greyhounds bid fair to surpass all existing scout cruisers. They will have a speed of 34 knots, a battery of six or eight 8-inch 250-pounder guns, and equipment for operating four airplanes from the deck. Neither the United States nor Britain is building any destroyers, but Japan will add about a dozen to her fleet in the current year and start work on a further batch of twenty-four large boats.

So far as numbers are concerned, however, submarines will represent the most important additions to the world's navies in 1923. The United States expects to commission eighteen new under-water craft of ocean-going dimensions, leaving thirteen still unfinished. France may complete several of the submarines she began last year. Great Britain counts on finishing two boats left over from the war program and a third, of experimental type, begun in 1921. Japan will place at least twelve new submarines in service, including three of the new 1,500-ton ocean-going class, and continue work on about twenty others, which are in various stages of building or about to be begun.

Nor must the airplane carrier be omitted, since these vessels, in the opinion of experts, are destined to supersede the battleship as the prime unit of naval power. The United States and Japan are each building two 33,000-ton carriers, Japan having, besides, a smaller ship almost ready for service; Britain is about to commission the *Eagle* and *Hermes,* of 22,800 and 10,950 tons respectively; and France is reconstructing the battleship *Béarn* for aviation duty.

If all the auxiliary craft specified above were added together they would make quite an imposing total, showing that naval disarmament is far from being an accomplished fact. It remains to be seen whether the powers will rest content with the auxiliary fleets they are now developing.



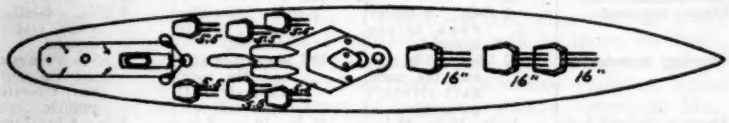
A Study of the Conference Battleship

Present indications are against such an assumption. Naval opinion in the United States demands more cruisers and submarines, and there is no denying the absolute need of a new program if the American Navy is to attain its treaty ratio of strength. But if additional cruisers and submarines are built in the United States, Japan is virtually certain to expand her own program; and should that occur Great Britain, having regard to those world-wide shipping interests on which her very existence depends, might consider it necessary to build new defensive ships as a counterpoise to these potential commerce raiders abroad.

If circumstances trend this way, there will be ample scope for a new competition in sea armaments, less expensive than battleship rivalry, but perhaps equally provocative of international friction.—Hector C. Bywater in *Baltimore Sun*, 12 May, 1923.

THE WASHINGTON CONFERENCE BATTLESHIP.—Shortly after the armistice a leading naval architect, Sir George Thurston, published in Brassey's *Naval Annual* of 1920-21 an article in which he outlined the features of the probable, or possible, battleship of the future. The design was based upon the trend of battleship design in recent years and upon the lessons of the battle of Jutland. In those days there was no limit upon the size of warships other than that imposed by the facilities of the shipbuilding yards and the depth of the National purse.

After admitting the limitations imposed by heavy cost, he says, "We have, therefore, only to estimate the maximum possibilities in the present position of engineering science, in order to arrive approximately at the type of capital ship which is the ultimate aim of the principal naval powers,"



DECK AND GUN PLAN OF THE CONFERENCE BATTLESHIP

and he finds that such a ship would be 932 feet in length, 112 feet broad, and of 31 feet 6 inches draft. It would mount eight 18-inch 45 caliber guns, firing a 3,300-pound capped projectile with a muzzle energy of 131,800-foot tons, capable of penetrating about six feet of solid wrought iron at the muzzle. The shaft horsepower for a speed of 33½ knots would be 200,000, and the displacement would be 57,000 tons. The cost of such a ship, says Sir George, would be prohibitive to all but the most powerful nations; and even for these the battlefleet would be restricted to a much reduced number of such great ships.

Now this article was written before the Washington Conference, and it serves to emphasize the wisdom of that clause of the Treaty, which restricts the size of future battleships to 35,000 tons. Had it not been for the Conference, Great Britain would now be building four battleships of forty-seven to fifty thousand tons, and if Admiral Beatty had had his way they would have mounted the powerful and costly 18-inch gun. The United States would have countered probably, by going to Thurston's limit of 57,000 tons, and Japan, no doubt, would have followed suit. This would have meant that the future naval appropriations would have been counted not in millions but in billions.

As a most interesting supplement to his previous article, Sir George Thurston has written for the 1923 edition of Brassey's *Naval Annual* an article in which he shows what it is possible to do under the restrictions of 35,000 tons displacement. He makes three separate studies of the

problem and gives the principal dimensions, etc., for three types of ship; one with the greatest number of large-caliber guns, the maximum amount of protection, and a moderate speed of 24 knots; another with a reduced number of large-caliber guns, somewhat lighter armor, and a high speed of 30 knots; the third design is for a battleship with the maximum number of guns, but with very light armor (for a battleship), and a speed of 30 knots. He is of the opinion that the first type, conforming broadly to the modern battleship of the type of our own *Maryland* and the British *Royal Sovereign,* is the one which probably will be adopted.

The accompanying illustration, which is based upon a sketch by Percy F. S. Spence, drawn for Sir George's article in the *Annual,* shows with considerable detail the general appearance of the ship. In view of the professional standing of the author and his intimate relation with British naval construction, it is probable that the two 35,000-ton battleships, which Great Britain is beginning to build under the treaty, will conform rather closely to the design here shown. The principal features of the ship are shown under Plan A in the accompanying table.

	PLAN "A"	PLAN "B"	PLAN "C"
Length	700 ft. 0 in.	730 ft.	770 ft.
Breadth	104 ft. 0 in.	104 ft.	104 ft.
Draught	28 ft. 6 in.	27 ft. 9 in.	26 ft. 6 in.
Displacem't (Conference)	35,000 tons.	35,000 tons.	35,000 tons.
Displacement inclusive of 1,000 tons fuel for trial condition	36,000 tons.	36,000 tons.	36,000 tons.
S.H.P.	55,000	125,000	120,000
Speed in knots	24	30	30
Primary armament	9 16-in., 45-caliber guns, triple mounted.	6 16-in., 45-caliber guns, triple mounted.	9 16-in., 45-caliber guns, triple mounted.
Secondary armament	12 5.5-in. or 6-in. guns and the usual anti-aircraft guns, etc.	12 5.5-in. or 6-in. guns and the usual anti-aircraft guns, etc.	12 5.5-in. or 6-in. guns and the usual anti-aircraft guns, etc.
Armor on sides and decks	15 in., 14 in., 13 in., 7 in., 5 in.	13 in., 10 in., 7 in., and 5 in.	8 in., 6 in., 7 in.
Armor on gun positions	16 in. to 10 in.	14 in. to 10 in.	12 in. to 10 in.

The first impression of the ship is that of its extreme novelty, with the whole of the main battery forward, the motive power aft, and the secondary battery grouped snugly amidships. This novelty, however, is incidental; for the ship has been designed to conform as closely as possible to the lessons that were taught at the battle of Jutland. The grouping of the nine 16-inch guns in three triple turrets forward is done to secure heavy end-on fire, and also a wide arc of fire of over 300 degrees. Another most important advantage is the superior protection of the magazines which is possible. Three battle cruisers were blown out of existence at Jutland by shells, or the flash of them, which penetrated to the magazines. Boilers and engines may be partially disabled, the steering gear also, and the ship may still fight on; but let a high explosive shell reach the main magazines, and there will be no ship left to fight. Grouping the guns in this way, then, has the added advantage that the side and deck protection of the magazines, being concentrated, can be considerably thickened. Successive steel decks, horizontal and sloping, will place the magazines of the main guns on this Conference battleship beyond any possibility of disaster—in other words, the shells will be detonated before they reach the protective deck.

The great concentration of gun weights forward is balanced by the placing of the machinery in the after third of the ship. Immediately abaft of amidships are grouped the six turrets that contain the battery of 5.5

anti-torpedo guns. The armor on the sides and decks ranges from fifteen inches to five inches, and it is a pretty safe guess that the larger portion of this, because of the steep angle at which the shells will fall in future sea fights, will be devoted to horizontal and inclined deck armor. The 16-inch gun positions will carry armor varying from sixteen inches in the port plates to ten inches in the barbettes and in the side and rear portions of the turrets.

In the drawing, our artist has shown the guns at half elevation, suitable to fighting at medium, modern ranges; but with the powerful 16-inch gun, and with the probability of engaging the enemy as soon as he can be reached, it is quite possible that the majority of future fights, where there is reasonable visibility, will take place at from twenty to thirty thousand yards, calling for an elevation of, say, twenty-five to thirty degrees. With this high angle of elevation the guns of No. 3 turret would not be masked, or would be very little masked, even in fire-ahead, by turret No. 2.

Another striking novelty in the Conference battleship is the masting; for in the endeavor to provide several reserve fire-control platforms, the ship carries no less than six masts, big and little. The forward tripod mast is enclosed by a lozenge-shaped plate-steel tower, conforming to the tripod, which serves to house several searchlights during day fighting, an arrangement which it now followed in some of the later wartime British battleships. Around the mainmast are grouped in triangular fashion three vertical tubular masts, each of which carries its own platform, from which the ship can be fought. The large single elliptical smokestack serves for the whole of the boiler plant. Reduction gear turbines of 55,000 horsepower developed on four shafts, serve to give the ship a speed of 24 knots.

Although we are strongly of the opinion that, in the present state of the art, and of the strategy and tactics of naval warfare, plan "A," as above outlined, will be preferred by naval officers, there will be those, no doubt, who will favor the ship shown in plan "C," which, with the same battery of nine 16-inch guns, and at a great sacrifice in defensive qualities, would have a speed of 30 knots as against 24 knots.—*Scientific American*, May, 1923.

AIRSHIPS A NECESSITY FOR THE UNITED STATES.—In the Baltimore *Sun* of April 13, 1923, there appeared an article by Hector C. Bywater which stated that airships were of limited use in time of war. Mr. Bywater attempted to show in his article that the United States Navy, which is developing rigid airships for this country, is engaged in an expenditure of public funds on an expensive and utterly useless plan, and, further, that airships are likely to prove absolute death traps for those who are foolhardy enough to go cruising in them during a war.

Mr. Bywater seemingly has based his knowledge of the airship situation on the fact that he has seen rigid airships in flight in Germany, has seen them in action when they were dropping bombs over London, and also states that he has read the official German reports of their Zeppelin fleet and its achievements, I submit that this is hardly sufficient proof to establish qualifications as an airship expert.

As a matter of fact, Mr. Bywater is not an airship expert, but is an expert on naval affairs as they enter into the political and economic welfare of the British Empire. He is one of the most brilliant naval writers of the day. He is also one of the most trusted individuals in Great Britain as far as the British Admiralty is concerned.

There is a controversy in Great Britain between the British Admiralty and the Royal Air Force, a controversy which has laid bare certain facts—which facts are as follows:

When the Royal Air Force was created as a war measure the Admiralty turned over the Royal Naval Air Force to those in control of the Royal

Air Force, and naval aviation then became a part of a separate service and passed from the control of the Admiralty. Along with the Royal Naval Air Force went the airship section thereof, which immediately became a part of the Royal Air Force.

Not long after the establishment of the Royal Air Force the British Admiralty discovered that it had made a serious mistake; that the control of aviation by the Royal Air Force, in so far as it applied to the exigencies of the naval service, did not make for economy, and utterly failed to take into consideration the naval needs of the hour. There has been a constant effort on the part of the Admiralty to take back that part of the Royal Naval Air Force represented by the airship section. Such a move is looked upon by the Royal Air Service as an entering wedge for loss of control and the return to the Admiralty of naval aviation.

To combat this the Royal Air Force, under the guise of a measure of economy, has frowned upon the development and manufacture of rigid airships. At the same time there has been unanimity between the Admiralty and the Royal Air Force in discouraging any other nation entering the field until Great Britain can supply herself with a large fleet of such ships and obtain the ascendancy over all other powers.

Through the control exercised by the Allied council of ambassadors Germany has been unable to build rigid airships; consequently that nation is out of the race altogether. France, intent upon dominating the air in Europe, has concentrated on airplanes and seaplanes, and, with her restricted areas, has not found it necessary to develop rigid airships. Italy is building only semi-rigid airships of sufficient capacity to negotiate the Mediterranean.

No other European nation has the funds and the technical staff to produce such craft; consequently the United States alone appears to be a competitor with England. Propaganda has been emanating from British sources ever since the sale of the *ZR-2* to the United States, discouraging any further attempt on the part of this country to extend its air force by the addition of rigid airships of large size.

The answer to the question "Are airships of limited use in time of war?" There is but one answer; they are limited. So is every other type of craft that roams the seas, on the surface or beneath; but all types of naval craft combined, including air, surface and underwater, make a complete whole, which, properly maneuvered, from the strategical and tactical standpoint, make up the backbone of sea power, and, in our case, forms our first line of defense.

Howbeit, because destroyers are limited in their scope of action we do not scrap destroyers; because supply ships are limited in their scope and are extremely vulnerable we do not scrap supply ships, and, by the same token, because airships are vulnerable to a certain degree we should not neglect to develop that highly important arm of our naval service.

Of course, airships are vulnerable. Mr. Bywater, however, points out that the Germans lost fifty-two airships, therefore airships are not only useless but absolute death traps. As a matter of fact, the following is a summarization of airship operation by the Germans during the war, or, more properly, the summarization of the German rigid airship program until the *Bodensee* and the *Nordstern* were taken over by the Allies in 1919.

Germany built altogether from 1900 to 1919, 143 rigid airships. Of these sixteen were dismantled as obsolete, thirteen were dismantled and taken out of service because of lack of facilities for overhaul and replacement; sixteen were shot down in action; seventeen were wrecked as a result of action; fifteen were wrecked during forced landings in storms,

landings being under war conditions and very hazardous; sixteen were wrecked in bad landings by green crews; seventeen were destroyed in sheds by fire; four were destroyed while being handled on the ground by inexperienced crews at night; six were destroyed by fire in flight; seven were turned over to the Allies—two to Italy and one to Japan; seven were deliberately destroyed by their crews to keep them from falling into the hands of the Allies, wrecked in just the same way that the German fleet was scuttled at Scapa Flow; seven were partly built and work discontinued at the time of the Armistice; two were built subsequent to the signing of the Armistice and were put into commission and used as passenger ships until taken over by the Allies. Of these 143 ships, thirteen were commercial and carried thousands of passengers without the loss of a single life.

To further summarize, during the fifty-two months of the hardest-fought war of all time, Germany lost eighty-three rigid airships employed in actual wartime use. But how about the vulnerability of surface craft in wartime? During the same fifty-two months more than 13,000,000 tons of merchant surface vessels, representing $8,000,000,000, were sent to the bottom by enemy action. More than 1,200,000 tons of surface warships went down in action, while, during the same period, 2,000,000 tons of shipping was lost by the ordinary hazards of the sea, wrecked in storms and by bad navigation, just the same as the Zeppelins were wrecked in storms and by bad landings.

As a matter of fact, in the battle of Jutland, three enormous battle cruisers disappeared in a flash from the surface of the water with a loss of practically their entire crews; 3,500 men blown into eternity in an instant. As a matter of fact, in this battle the British lost fourteen warships, six of which were first line; the Germans lost eleven ships with a tonnage of 60,720 gross tons; and the officers and men killed and drowned were 6,447 for the British and 2,586 for the Germans, the high proportion of British dead being due to the six large ships that were sunk. It appears to the reasonable person that the case of vulnerability between airships and surface craft is six of one and half a dozen of the other.

Mr. Bywater states that German rigid airships had virtually no influence on war operations by land and sea. This does not agree with the facts. I have been told personally by an officer of the Imperial German Staff and on the Imperial German Council during the war that German Zeppelin attacks were made on England for two specific purposes: first, to damage British morale to such an extent that large forces of troops would have to be held on British soil as a safeguard against riots, strikes and political disturbances—and it is well known that upward of a quarter of a million troops were kept in England at a time when their presence on the western front would have been a critical matter to the German forces; secondly, anti-aircraft equipment, small dirigible blimps and a large number of aircraft squadrons were held in Great Britain to cope with the Zeppelin situation. Had all of that force been on the western front during the period of Zeppelin activity, the preponderance of air power along the Flanders sector of the western front would have passed out of German hands.

It is another well-known truth that on those occasions when the German fleet put to sea accompanied by Zeppelins the British sea forces were never able to make contact with them. It was this distressing state of affairs that caused the British to turn to the construction of British airships of the *ZR-2* or *R-38* type.

In desperation the British took enormous risks. They designed types of airships which neglected many essentials, including the factors of safety always present in German rigids. The result is well known: forty-

four of the most skilful airship officers and men, some British, some American, were killed by the mechanical failure and the destruction in the air of the *ZR-2*—a British ship; British built, and British handled.

The loss of the *ZR-2* furnished the Air Ministry with a decidedly acceptable excuse for stating that airships were no good and to offer to turn over free those airships which were left in Great Britain to any commercial company that would take them and operate them. Certain restrictions, however, made it impossible for anyone to accept such an offer. Then the British tried to sell some of their airships to the United States in part settlement of our claim against Great Britain for the loss of the *ZR-2*, all of which made excellent camouflage for public consumption, but covered up the deliberations of the Imperial Council held in London in August, 1921, and the desperate attempts of the British at the Council of Ambassadors in Paris to keep the United States from obtaining a rigid airship in Germany.

It was only by confronting the British officials at the Paris council with the figures evolved at the Imperial Council in London that our Navy was finally allowed a rigid airship, German built, of sufficient capacity to warrant an attempt to bring it across the Atlantic. In other words, at the conference in Paris Great Britain maintained that any airship larger than 27,500 cubic meters gas capacity was a war airship and could not be built under the Versailles treaty stipulation in Germany; while, at the same time, the Imperial Council in London declared that rigid airships of less than 100,000 cubic meters gas capacity were useless, even as commercial ships—one standard for themselves and another for the United States. This is the subject matter of Mr. Bywater's thesis.

Admiral Moffett, in a series of articles in *The Sun*, printed April 16-17, has covered the sensible use of airships adequately; *therefore, it is not necessary for me to continue this discussion further, except to say that rigid airships have an exceedingly important function in the military and naval establishments, while in the case of commercial aviation they are in a class by themselves as carriers of large cargoes and large passenger lists over longdistances and at high speed.

With the proper attention paid to design and construction, with the substitution of helium for hydrogen as a buoyancy medium, and with the development of oil-burning engines, they furnish one of the safest vehicles known to transportation. For the United States, with its enormous expanse of territory and the great distances between its continental limits and its Far Eastern insular possessions, such ships are a necessity.—Mr. Clifford A. Tinker, formerly of the Bureau of Aeronautics, United States Navy, in *Baltimore Sun*, 19 May, 1923.

*See PROCEEDINGS for June, 1923.

CURRENT NAVAL AND PROFESSIONAL PAPERS

"Largest Single-Cylinder, Single-Flow Reaction Turbine Yet Built."—(First of the new-type single-flow turbines undertaken by the Westinghouse Company. Large capacity at moderate peripheral speeds and conservative stresses made possible by Bauman system of blading; symmetrically expanding steam path eliminates eddies. Provision is made for bleeding at four points, and several new constructional features are incorporated.)—*Power*, 15 May, 1923.

"Model Screw Propeller Experiment with Mercantile Ship Forms."—(Paper read by G. S. S. Baker and W. C. S. Wigley before Institution of Naval Architects, 22 March, 1923.)—*Engineering*, 20 April, 1923.

"Ship Salvage Operations."—(Modern accessories and methods used in lifting the Zeebrugge Block-ships.)—Dudley E. J. Offord, R. C. N. C. in *Engineering*, 27 April, 1923.

"Recent Developments in Aircraft Engines in the Navy."—(An excellent review of the important work which has been completed or is in hand in connection with the development of the engine itself under Navy supervision and control.)—Lt. Bruce G. Leighton, U. S. N. in *Aerial Age*, May, 1923.

Pertinent Articles in:

Current History for May 1923:

(1) "The Fifth Pan-American Congress"—Editorial.
(2) "U. S. Policy Toward Latin-American Republics"—Editorial.
(3) "The Attack by Lloyd George on French Policy."
(4) "A Defense of French Policy." (Reply to Lloyd George)—Andre Tardieu.
(5) "Why America Refuses to Recognize Russia" (official text of statements by Secretaries Hughes and Hoover).

The Edinburgh Review for April, 1923:

(1) "The Principles of Diplomacy."—Professor W. Allison Phillips.

Atlantic Monthly for May, 1923:

(1) "The Armies of Europe."—Sir Frederick Maurice.
(2) "America Must Decide: A Study in International Detachment."—William Howard Gardiner.

The Fortnightly Review for May, 1923:

(1) "Three Months in the Ruhr."—John Bell.
(2) "Empire Foreign Policy."—J. A. R. Marriott, M.A.
(3) "From Coal to Oil: The existing Waste of Life and Money."—Archibald Hurd.

Journal of the Franklin Institute for May, 1923:

(1) "The Electron in Chemistry."—Sir Joseph John Thomson.
(2) "A Method of Transmitting the Telegraph Alphabet Applicable for Radio, Land Lines, and Submarine Cables."—George O. Squier.
(3) "Electric Circuit Filters."—Louis Cohen.

The Nineteenth Century for April, 1923:

(1) "Competition and War."—Arthur Cosperz.
(2) "Air Power."—Squadron Leader A. A. Walser, R.A.F.

The Nineteenth Century for May, 1923:

(1) "France, England, and the Ruhr: Some Plain Truths."— F. J. P. Veale.
(2) "The Overrated Submarine: Admiral Sir Cyprain Bridge, G.C.B."
(3) "The Officers' Training Corps: Its Great Value."—Major E. E. A. Whitworth.

NOTES ON INTERNATIONAL AFFAIRS

FROM APRIL 23, TO JUNE 23

PREPARED BY

ALLAN WESTCOTT, PROFESSOR, U. S. NAVAL ACADEMY

REPARATIONS AND THE RUHR

GERMAN OFFER REJECTED.—In accordance with British suggestions, Germany in a note to the Entente and United States Governments on May 2 made a new offer for a reparations settlement. The offer proposed payment of thirty billion gold marks, twenty billion to be paid before July 1, 1927, by raising a foreign loan, and the remainder in two instalments two years apart. The offer of a non-aggressive compact on the Rhine was renewed, and also that of settlement of disputes by international arbitration. It was stipulated that the Rhineland should be evacuated as soon as possible.

The French and Belgian Governments, without consultation with Great Britain or Italy, at once rejected the German offer, declaring that it presentcd no basis for negotiations, though the door was not closed upon further approaches. Great Britain and Italy also, in separate notes, pronounced the proposals unsatisfactory. The British note expressed the view that an unfavorable reception should have been foreseen, since the total payment offered was far below any previously proposed and was based on the extremely doubtful plan of a foreign loan, and since no definite guarantees or details were submitted. The British note expressed hope for more reasonable and definite proposals to follow. In the meantime, a French parliamentary document gave the total French expenses for the Ruhr occupation from anuary 11 to June 1 as 145 million francs offset by receipts of 102 million francs.

A new German offer was anticipated offering a definite plan for annual payments, backed by the nation's total productive resources—mines, factories, farms, fisheries, etc., with pledges of co-operation from both industrial leaders and labor unions.

RHINE ARMY CONFERENCE DEADLOCKED.—During May the Rhine Army Costs parley in Paris still failed to reach a settlement. The final difficulty arose over the prospect of a separate agreement between the United States and Germany for the payment of American private and public claims. In this event the Entente representatives suggested that the proposed preferential treatment of American army cost claims should be no

longer operative. The American position was that such separate arrangement should in no way affect the settlement of American claims under the Versailles Treaty.

LAUSANNE CONFERENCE

GREEKS REFUSE TO PAY INDEMNITY.—During May the Lausanne Conference reached almost complete agreement over the economic terms of the Turkish settlement, but was threatend by a rupture between Greece and Turkey over the question of war indemnity. M. Venizelos, speaking for Greece, set forth the absolute unwillingness of Greece to make any payment to Turkey, and sought a preliminary expression of sentiment in the Conference in support of this position. All that Turkey was willing to concede was that the amount to be paid by Greece should be settled by arbitration.

The attitude of Greece was strengthened by her recent economic agreement with Jugo-Slavia providing that state with a commercial outlet at Saloniki. The Jugo Slav army was reported one of the best equipped in Europe, and in a Balkan conflict capable of expansion to a million men. The Greek army had also been strengthened after its debâcle in Asia Minor.

ECONOMIC TERMS.—On May 15 it was announced that virtual accord had been reached in economic points of the Turkish Treaty, except in the matter of concessions, which were to be dealt with separately at Angora. Earlier in the conference, on April 30, the French delegate stated the firm intention of France to get a fair settlement of the debt owing to her, retain her 1914 concessions in Asia Minor, and stay in Syria, to which two divisions of troops were ready to depart if needed.

Minister Grew indicated that while favoring the open door, the United States Government would not support concessions to Americans if in conflict with those previously granted to other powers or their citizens.

GREAT BRITAIN AND IRELAND

BALDWIN SECCEEDS LAW AS PREMIER.—Owing to persistent ill health, depriving him of the use of his voice in parliament, Premier Bonar Law resigned the Premiership on May 20. He headed a conservative ministry upon the resignation of Premier Lloyd George last year, and was given a majority in parliament in the ensuing elections in October.

On May 22 the King named as Premier the former Chancellor of the Exchequer in the Law ministry, Stanley Baldwin.

CESSATION OF DISORDER IN IRELAND.—In a proclamation on April 27 Eammon de Valera offered to come to terms with the established government, and at the same time announced that his supporters had been ordered to cease operations. This offer was ignored by the Free State

Government. Ireland, however, profitted by the cessation of guerilla warfare and destruction of property.

RUSSIA AND NORTH EUROPE

BRITAIN THREATENS TO END TRADE AGREEMENT.—On May 8 the British Government sent a sharp memorandum to Moscow citing violations of the Anglo-Russian Trade Agreement and threatening an abandonment of the agreement unless satisfactory explanations were offered in ten days' time. The Memorandom specified anti-British propaganda in the Near East and Indian border states, activities through the Third International Communist organization, and direct offenses against the rights of British citizens in Russia.

The reply consisted of an evasive defense and explanation, and an appeal for a general conference between the two nations.

Great Britain extended the time limit, and on May 17 opened discussions with Leonid Krassin, Soviet Commissar of Foreign Trade. The British Government stood firmly on the demands of the Memorandum, and it was indicated that Russia would make the utmost concessions possible to avoid rupture of commercial intercourse and withdrawal of British restraining influence upon the states on Russia's southern frontiers.

LEAGUE OF NATIONS

LEAGUE COUNCIL AT GENEVA.—The session of the League Council ended at Geneva on April 23 was marked by some results of considerable interest. The Vilna controversy was aired again, Lithuania declaring her intention to bring the matter before the Assembly in September. A Dutch financial adviser was appointed for Albania, to assist in the framing of its budget, road construction, and negotiation of a small foreign loan. It was announced that Austria was making steady progress and was about to negotiate a loan of roughly $150,000,000, secured by revenue producing assets, and guaranteed by Britain, France, Italy, Czecho-Slovakia, and other European states. A mission was to be sent to the United States to place part of this loan.

Criticism was offered of the administration of the Saar Valley, especially of the doubling of the number of French troops because of a miners' strike, and the issue by the Governing Commission of an "extraordinary decree" setting fine and imprisonment as the punishment for "casting discredit on the Treaty of Versailles" or "insulting or traducing the League of Nations, its members, or the states signatory of the Treaty of Versailles." This criticism was advanced by M. Brantung, the Swedish member of the Council.

FAR EAST

CHINESE BANDITS HOLD FOREIGNERS.—On May 7 Chinese bandits derailed the North-bound Shanghai-Peking express and took captive a large

number of Chinese and foreign passengers. Some of the foreigners, including all the women, were later released, but fourteen men, including five Americans, were held prisoner in the mountains back of Lincheng, in Shantung province. Among the Americans were Mr. J. B. Powell, newspaper correspondent, Major R. W. Pinger, U. S. A., and Major R. A. Allen, U. S. A.

Diplomatic pressure was brought upon the Chinese Government to effect the release of the captives, but up to May 23 without result. The bandits, who numbered thousands, demanded the withdrawal of government troops on penalty of death to the captives, and called for a promise, backed by foreign guarantees, of the incorporation of 8,000 of the bandits and their leaders into the national army as the regular force in Shantung. Negotiations were hindered by the weakness of the Chinese Government and rivalry between leaders of the Anfu party and the Chili party in control at Peking.

UNITED STATES AND LATIN AMERICA

NEGOTIATIONS WITH MEXICO.—Charles B. Warren and John Barton Payne, American Commissioners sent to negotiate for resumption of friendly relations with Mexico, arrived in Mexico City on May 11. In subsequent discussions the American commissioners made clear that recognition depended solely on Mexico's attitude toward foreign property rights in Mexico.

RESULTS OF PAN-AMERICAN CONFERENCE.—The Pan-American Conference at Santiago adjourned on May 3 without results of great importance. The proposed adoption of the Monroe Doctrine by all South American states was not favorably regarded by the United States delegates, who spoke of the doctrine as a "unilateral national policy of the United States." The limitation of naval armaments failed, owing partly to the unwillingness of Brazil to give up her capital ship program.

Treaties were drafted for protection of trade-marks, co-operation in health measures, and for an agreement providing for investigation of international disputes by a fact-finding commission.

REVIEW OF BOOKS

NAUTICAL TABLES, by F. T. A. Cedee. Duinker's Boekhandel, Helder, Holland.

A Review by Lieutenant Commander R. E. Rogers, U. S. Navy

The book contains a description of methods, with accompanying tables, for solving observations for line of position, the system being described in the preface as "a complete method of finding the position line in any case." The principle involves the projection of the circle of equal altitudes on the Mercator chart. Elements employed in the solution consist of the latitudes of the north and south "tops" of the position circle, the cartographic latitudes of these points (taken from a table in the form of a logarithmic chart) and the mean of these, the corresponding value of which gives the first argument for entry in a table for selecting the azimuth and corrections to the assumed (D. R.) position. The other argument is the cartographic difference between the assumed latitude and that of the nearest north or south top. The two corrections give a point on the line of position, the selected azimuth corresponding to this point. Details of procedure vary with altitude greater or less than declination, and with azimuth greater or less than forty-five degrees. Descriptions and definitions are printed in English, Dutch, and German. Symbols and nomenclature are in some cases different from those employed by American navigators but this variance does not produce any considerable difficulty in becoming familiar with the precepts and their application. Some practice is required for ready use of the cartographic latitude conversion chart. A manifest improvement would consist of a direct table of corresponding values.

While the method provides for accurate results with simple interpolations, the complete solution requires practically the same amount of time and labor as the various rigorous solutions of the astronomical triangle on the St. Hilaire principle. It is not likely therefore that the system will appeal to present users of St. Hilaire methods.

POSITION FINDING AT SEA (Based on Method of De Aquino), by Gilbert P. Chase, Lieutenant Commander, U. S. Navy (Retired). D. Van Nostrand Company, New York. $1.00.

A Review by Lieutenant Commander R. E. Rogers, U. S. Navy

The position line is explained, and its uses and limitations clearly presented. Particular attention is called to the fact, well known but often

not considered, that lines resulting from observations of bodies on the meridian or on the prime vertical, are, in themselves, of equal value only with lines from bodies in any other direction.

For solution of observations, a very positive recommendation for the use of the tables of De Aquino, as contained in *Hydrographic Office Publication 200,* is based on the author's expressed conviction that the method is the simplest and easiest known at the present time. Solutions for a wide variety of conditions, involving seventeen separate observations, are given, all except meridian and Polaris sights being solved by the method recommended. Details of the use of the tables are, however, not explained. While this procedure is consistent with the author's prefactory remark that he has purposely avoided the descriptions, discussions, and explanations to be found in existing textbooks, the omission of these details results in a failure to provide a direct opportunity for judging the merits of the method.

Regardless of whether the individual reader uses, or purposes to use, the De Aquino methods, the book contains much that will be of value to practical navigators as well as to students of navigation. The use of the star chart, with the addition as recommended, of the plotted positions of the sun, moon, and planets—"to be regarded as something to be looked at repeatedly"—provides a means of planning the work, and of eliminating vexatious delays in identification, particularly in a broken sky. The minor item of using the watch error on G. M. T., in place of the practice involving C-W, saves a step in computation, with no resulting disadvantage.

Under the head "The Human Factor," the importance is stressed of an independent check on the operations of setting a course, measuring a distance, and taking a sight. This and certain points regarding the procedure following a period of unfavorable weather, under "Observations and the Run," are presented in a manner that must definitely impress any reader.

SECRETARY'S NOTES

Membership Present membership, 4627. Changes since January 1, 1923: New members, 164. Resignations, 66. Deaths, 15. Total Increase, 83.

Changes in Board of Control Commander H. D. Cooke, U. S. Navy resigned from the Board of Control, due to his detachment from the Naval Academy, and his resignation was accepted with regret. The following were elected members of the Board of Control to fill vacancies:

Captain P. B. Dungan, N. S. Navy.
Lieut. Comdr. M. S. Tisdale, U. S. Navy.

Dues Members who have not yet paid their dues for 1923 are urged to do so promptly. The amount of outstanding dues is in excess of $8,000, which is a heavy drain upon the Institute's resources. The interest alone upon this sum is about $400 per year.

Subscription Rates In order to bring the subscription rate more nearly in line with the cost of publication, the Board of Control has increased the subscription rate to $5.00 per year. A special rate of $3.50 per year is made to members only (not available to societies or organizations) in order that they may send subscriptions for the PROCEEDINGS to their relatives and friends. (Foreign postage 50 cents extra in all cases). Subscriptions are automatically discontinued at expiration.

Articles The Institute desires articles of interest to all branches of the service, including the reserve force. Non-members as well as members may submit articles, and authors receive due compensation for articles published. Compact, well digested articles are more likely to be accepted for early publication. In accepting articles for publication, the Institute reserves the right to have such articles revised or rearranged, where necessary, in order to bring them up to the required

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standard of articles published in the PROCEEDINGS—the cost, if any, to be deducted from the compensation due the author.

Reprints of Articles Twenty copies of reprints are furnished authors free of charge. Additional copies to the number desired will be furnished at author's expense, provided request is made before going to press.

Discussions Discussion of articles published in the PROCEEDINGS is cordially invited. Discussions accepted for publication are paid for at approximately one-half the rate for original articles.

Book Reviews As soon as practicable after the publication of books on subjects of professional interest, the Institute aims to publish authoritative reviews of them.

Address of Members To insure the delivery of the PROCEEDINGS and other communications from the U. S. Naval Institute, it is essential that members and subscribers *notify the Secretary and Treasurer of every change of address without delay*. No responsibility can be accepted for failure to receive the PROCEEDINGS, where members fail to comply with this rule.

H. G. S. WALLACE,
Commander, U. S. Navy, Secretary and Treasurer.